Editorial

LAST month I had something to say about radio in Australia as we saw it during the last 12 months. With the commencement of a New Year, it is only logical we should look forward to the 12 months yet to come, turning over in our minds what we shall do in that period, and endeavoring to forecast what we shall meet.

As we go to press, we learn that on the night of December 5, interstate communication on six metres was achieved for the first time. A number of Sydney and Melbourne amateurs maintained contact for pproximately two hours, and there have been reports of reception in Syd- ey from both Tasmania and Queensland.

Such happenings after so many years of endeavor lead us to hope that great deal of interest will be focused on ultra-high frequencies in 1947. ropagation reports indicate that conditions favorable to such communi- tion will prevail for some months at least.

There is no reason of course why these interesting things on ultra-high equencies should be confined to transmitting amateurs. Many of our ders spend much time in listening to amateur transmission on the lower equency bands. A simple converter capable of UHF reception seems learly indicated, therefore, in our plans for the immediate future.

Apart from the more or less routine design of broadcast receivers of types, experimental FM and television could quite easily take shape t year. From the amateurs' point of view, simple disc television might ll be an excellent thing as a means of introducing the subject in a mparatively simple and inexpensive way. At the moment, transmissions this type are not permitted by the PMG, but I feel it is only a matter time before such restrictions are removed. Electronic television is by means such a simple matter, introducing factors of cost and complexity ich would seem to reserve it for the few.

I would be interested to hear the views of our readers on this particular tter, as we are prepared to consider simple television transmissions and e design of equipment if it appears that sufficient interest would result. e use of this technique appears somewhat archaic on the surface, but possesses many advantages from the experimenters' point of view. What you think?

A good deal of all these plans seem to tie up with amateur activity. at's mainly because really big new things in radio are particularly suit- le for such experimental work. But it does not mean that the broadcast tener, amplifier fan, &c., will not be well catered for.

And finally, don't forget our information service. We shall continue to ecialise in handling your problems and help- g you to get the most from radio, no matter hich branch is your own particular interest. should be a great year, 1947! Here we me!

John Moyle

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183 ELIZABETH STREET, MELBOURNE.
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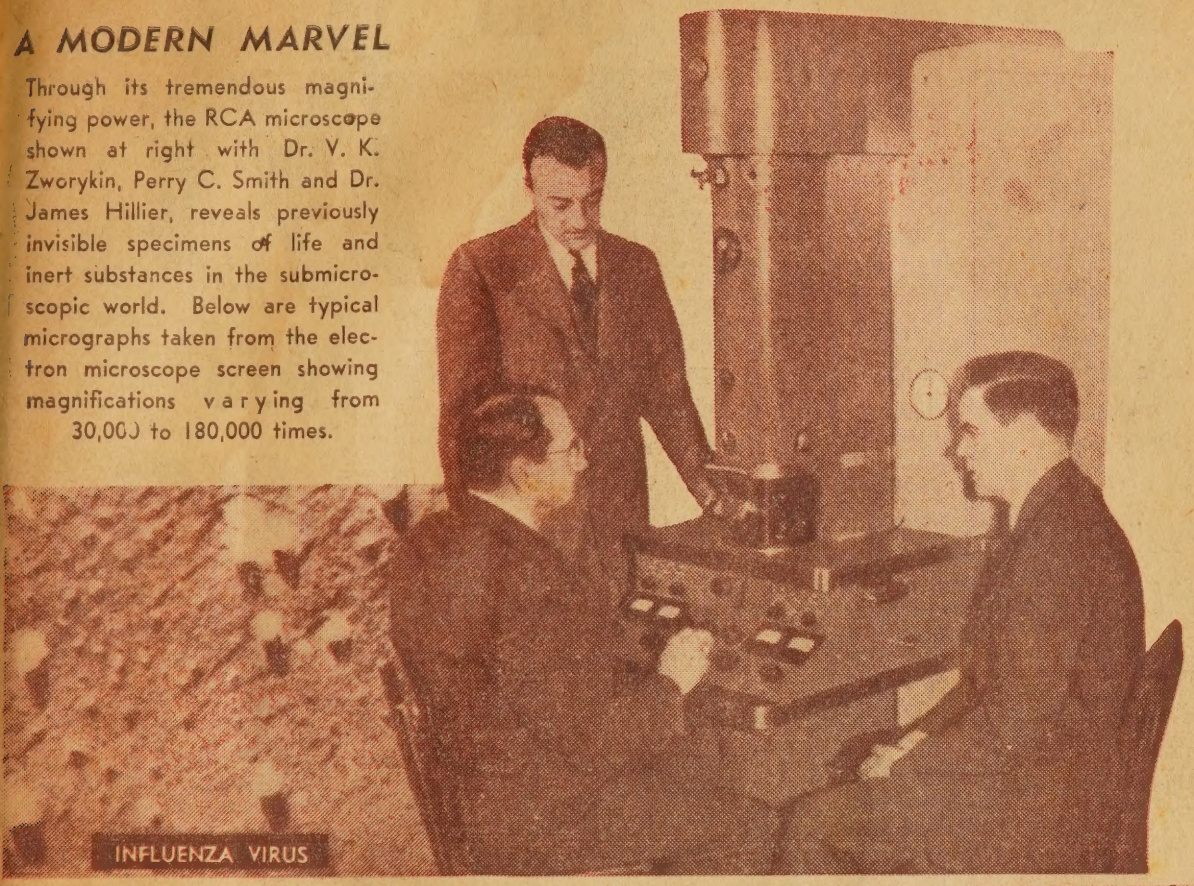
TECHNICAL EDITOR: W. N. WILLIAMS, A.M.I.R.E.

THE ELECTRON MICROSCOPE

A MODERN MARVEL

Through its tremendous magnifying power, the RCA microscope shown at right with Dr. V. K. Zworykin, Perry C. Smith and Dr. James Hillier, reveals previously invisible specimens of life and inert substances in the submicroscopic world. Below are typical micrographs taken from the electron microscope screen showing magnifications varying from 30,000 to 180,000 times.



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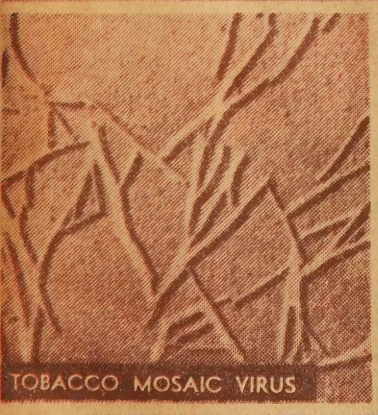

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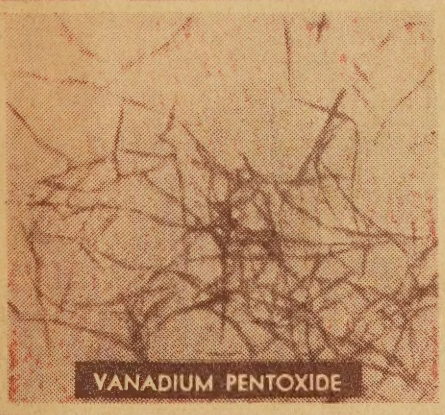

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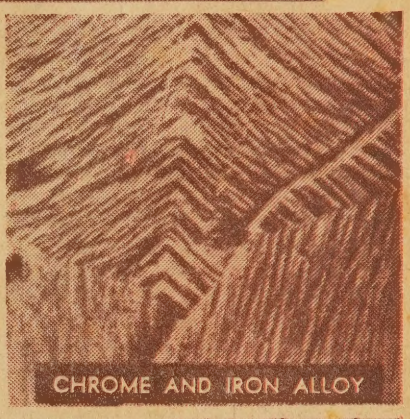
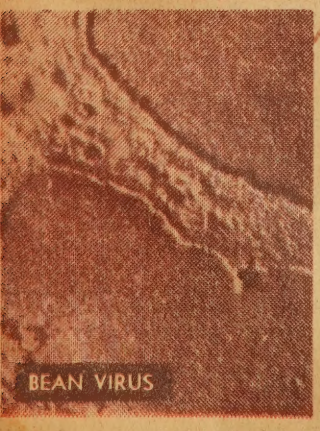
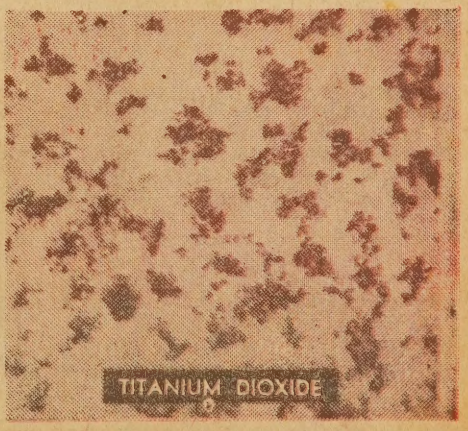


CHROME AND IRON ALLOY



BEAN VIRUS

"PERFECT" DIAMOND FACET



TITANIUM DIOXIDE

How about F.M. this year?

Not a great deal has been done this year to bring F.M. to Australia. The period of investigation is in progress. Set owners may still consider their present sets good enough for many years to come. In this regard, we are in much the same position as we were twelve months ago.

by John Moyle

FOR our March issue of last year I wrote an article in which I attempted to sum up the pros and cons of F.M. and Television in Australia as I saw them, and to assess their value to Australia in the near and distant future.

I said that F.M. appeared certain to become part of our radio system sooner or later—most probably later than sooner. That it would allow higher quality—and priced—sets to be made than at present, but that greater freedom from static and electrical interference would be its main value to the average listener. I said that present A.M. stations would be used for country reception for as long as we can see ahead, and that from the industry's point of view, the provision of extra channels for broadcasting was a most important consideration.

Since the publication of that article, nothing has transpired to alter my opinions. It may be of interest, however, to reconsider the position as it exists at the present time, and in the light of progress that has been made.

The most important step as far as F.M. is concerned is the acceptance by the Standing Committee on Broadcasting of the PMG's recommendation that experimental stations should be erected in each capital city.

F.M. EXPERIMENTS

This is in line with the hope I expressed that no one here would rush into F.M. without a thorough investigation and knowledge of what it entailed. None of the experimental stations is officially in operation at the time of writing, although I do not expect it will be long before some of them are on the air. Incidentally you as a set owner will not be able to receive these transmissions on your present receivers.

I have listened to the opinions of many men during the last few months on the matter of F.M. in Australia, and I still consider that there is a definite tendency to exaggerate its value to the listener. Not that F.M. cannot give infinitely better reproduction on large, multi-valve receivers under ideal conditions, or reduce unwanted interference. It can. But both these points are of interest to a comparatively small section of the listening public. For the remainder, who require inexpensive, small sets, the advantages are not so enticing.

As was so clearly demonstrated at a recent lecture given before the NSW division of the Institute of Radio Engineers, F.M. sets at the moment, if they are to extract the full possibilities of the system, will be complicated, large and costly. No appreciable progress has been made in the design of an equivalent 4/5 valve set selling for about £20, which is the backbone of the radio trade at the moment, and probably always will be.

Moreover, I believe that radical changes in design technique will be called for before such sets will be possible.

In reply to a question at the IRE meeting referred to, I was assured by the very capable lecturers that just as superhets of the past developed from multi-valve models to our present simplified designs, so it will be with F.M. I agree, but I do maintain that the development of these old-time circuits was made possible only by changes in technique.

Not one section of the old-time receiver remains today in its original form. R.F. amplifiers now use screened pentodes, the mixer stage uses a modern converter, I.F. stages are completely re-designed, de-modulator and audio stages also use new type valves made especially for them. These are all changes in technique, and their counterparts in F.M. receivers are as yet barely indicated.

I believe also, that our radio engineers agree with this opinion. After some discussion at that meeting, it was obvious that the main drive behind F.M. development was the desire to create new channels, and not merely advantages it might hold for the average listener. I do not suggest that this is not an adequate motive for pushing ahead but I do think we shall do well to recognise it, admit it, and proceed on this realistic basis.

I do not think the present tendency to over-emphasise what the listener might get out of it is good policy. It would be a bad thing—possibly a fatal thing—if in the end the listener suspected that he had been "sold a pup," all because of what might even be called a distortion of the facts, however well intentioned.

We would do well to remember in this connection that a number of ancillary problems tack themselves to the main issue. I fancy the design of portable receivers, for instance, will present many headaches for tomorrow's technicians.

Then there is the matter of aerials for F.M. I cannot accept assurances rather easily presented by some that a wire round the picture rail will still be a satisfactory solution. Wide experience with V.H.F. and U.H.F. communication during the war taught us that for maximum results, properly designed and installed aerial systems were part and parcel of an equipment.

The same story is likely to be true of F.M. and of television. There will be localities where signals will be OK on almost any aerial. But if an already restricted coverage is to be extended to the full, we will not be able

At the moment—

- EXPERIMENTAL STATIONS ON THE WAY
- NO RECEIVERS AVAILABLE YET
- ONLY BIG SETS APPEAR PRACTICABLE
- MOST FACTORIES "WAIT AND SEE"

to ignore the importance of the receiving aerial, its dimensions, its system of feed and matching, and its erection. A lead has already been given overseas in the marketing of special aerial kits for the job.

At the moment, the radio trade does not appear to be well equipped for the design and production of F.M. sets for broadcast reception. For many of the reasons given above, it is hard to blame them. There is a danger that things will sooner or later move too quickly for any but highly financed firms to keep up with them. Moreover, I am certain that the whole matter must sooner or later be technically simplified. Only an article essentially simple in design, easy to manufacture, consistent in performance, and capable of rapid service and maintenance can ever be a commercial proposition no matter what marvels it may offer. Moreover, it must not cost more than the majority of the market can pay.

F.M. is not yet in this position in Australia, and I do not think it will be for some time to come.

Results of BBC Field Trials

The following extracts from the "Wireless World" give an account of F.M. tests made by BBC engineers to ascertain its performance in practice. As our own PMG engineers are expected to produce information of a similar type, these extracts are informative and timely.

THE use of frequency modulation at high carrier frequencies has been widely adopted in the USA for broadcasting and it has received so much publicity that many have formed the opinion that the more commonly used amplitude modulation is obsolete. It is widely believed that F.M. reduces noises of all kinds, including circuit and valve noise, car ignition and electrical machinery interference, as well as atmospherics; it is often claimed, too, that it improves the transmitter efficiency, increases the service area of a station and eliminates fading. Much stress has also been laid on an alleged improvement in the quality of reproduction obtainable.

In some cases the claims made for frequency modulation have been unquestionably exaggerated and in order to determine its capabilities the BBC decided to carry out actual trials in England. The results of these trials are published in the *BBC Quarterly* and are of considerable importance.

The first tests were carried out at 45 Mc/s with two 1-kW transmitters, one being installed at Alexandra Palace and the other near Oxford. One of them was later removed to Moorside Edge for tests in hilly country. The tests were afterwards repeated with a frequency of 90 Mc/s. The tests comprised propagation trials (measurements of field strength *versus* distance for both horizontal and vertical polarisation); fading measurements; a comparison of F.M. and A.M.; signal-noise ratio measurements, and practical listening tests.

All normal forms of noise in reception consist of voltages varying in amplitude, and with amplitude modulation relatively little can be done to eliminate them.

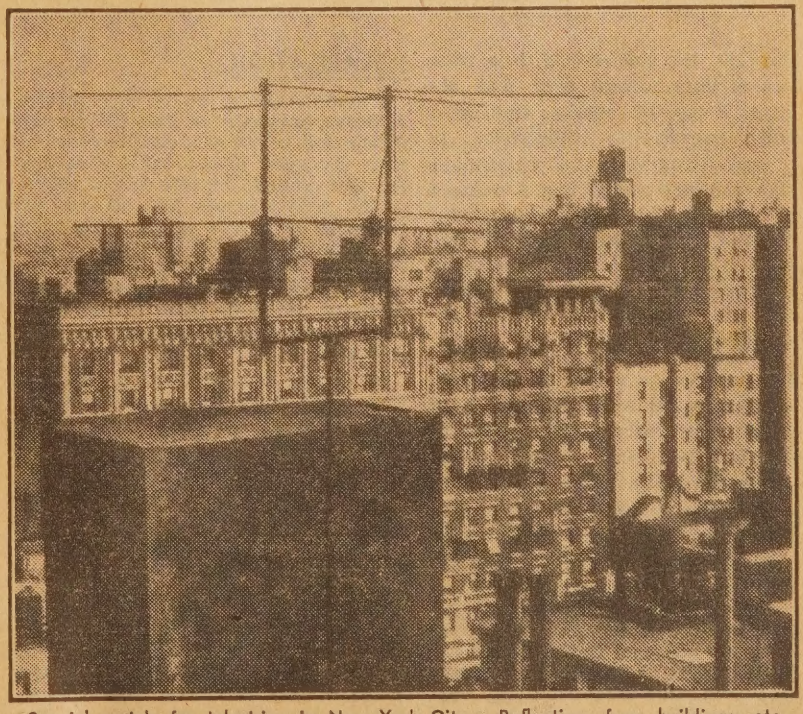
NOISE REDUCTION

Frequency modulation offers great possibilities of noise reduction because the noise, being in the form of amplitude changes, is of different character from the modulation. The use of an amplitude limiter has no harmful effect on the F.M. signal and it substantially prevents the amplitude changes of noise from reaching the discriminator and detector circuits.

However, it must not be supposed that the complete elimination of all noise is possible. Noise can phase-modulate the signal in some degree and will then be passed, and there are various other ways in which even with a perfect limiter noise can be combined with the signal so that in some degree it is passed through to the discriminator.

The BBC tests have shown that in the case of receiver noise—that is, valve and circuit hiss—frequency modulation is about 25 db better than amplitude modulation. A satisfactory service can be obtained with a field strength of 50uV/m as compared with 900uV/m for A.M. For a high quality, very low noise, service F.M. would need about 200uV/m.

In the case of external noise, F.M. has still a considerable advantage over A.M. Atmospherics are in any case considerably less on frequencies above 45 Mc/s than on the relatively low frequencies normally used for broadcasting, however, and this is also true of some kinds of interference from electrical machinery. When the advantage of F.M. is added, the net improvement is considerable. Car ignition systems prove the most important source of external noise at high frequencies.



Special aerials for television in New York City. Reflections from buildings, etc., play an important part in determining the character of F.M. and television signals.

TABLE I—RANGE OF IGNITION INTERFERENCE.

Field Strength 45 Mc/s Half-wavelength dipole 30 feet above ground (uV/m)	Extinction Distance F.M. Horizontal polarisation (yards)	F.M. Vertical polarisation (yards)	A.M. Horizontal polarisation
50	200	200	At 100 yards the ignition was very disturbing, but merged into the set noise which was very high.
100	150	200	As above, but less disturbing.
300	80	120	Perceptible at 100 yards but merging into the set noise.
500	60	120	
1000	40	80	190 yards.
5000	25	50	120 yards.

TABLE II—SERVICE AREAS FOR 45 Mc/s.
(Horizontal polarisation)

Height of transmitting aerial above surrounding country (Feet)	No. of aerial stacks.	Aerial gain in field strength.	Aerial power (kW)	Field-strength multiplier from 1 kW with single dipole.	Radius of service area (miles) Receiving dipole aerial 30ft. above ground. 5mV/m 1st class urban service	1mV/m 2nd class urban service.	200uV/m 1st class rural service.	50uV/m 2nd class rural service.
1000	8	2.8	50	20	35	57	78	120
500	8	2.8	50	20	26	44	66	86
500	8	2.8	10	9.0	19	35	55	75
200	4	2.0	5	4.5	9	18	34	52
200	4	2.0	1	2.0	6	13	25	41
100	2	1.4	0.25	0.7	2.5	6	12	30

TABLE III—SERVICE AREAS FOR 90 Mc/s (PROVISIONAL)
(Horizontal polarisation)

Height of transmitting aerial above surrounding country (Feet)	No. of aerial stacks.	Aerial gain in field strength.	Aerial power (kW)	Field strength multiplier for 1 kW with single dipole	Radius of service area (miles) Receiving dipole aerial 30ft. above ground. 2mV/m 1st class urban service.	500uV/m 2nd class urban service	200uV/m 1st class rural service.	100uV/m 2nd Class rural service.
1000	8	2.8	25	14	40	56	67	76
500	8	2.8	10	9	26	38	49	57
200	4	2.0	5	4.5	13	23	30	38
200	4	2.0	1	2.0	9	17	23	30
100	2	1.4	0.75	0.7	5	8.0	12	17

However, the use of F.M. is a considerable improvement over A.M. although it by no means eliminates ignition interference completely. It has been found that the polarisation of the radiated signal has a marked effect and that horizontal polarisation is distinctly better than vertical. This effect has been found also at 90 Mc/s, and is confirmed by American tests.

IGNITION

The relative performances of F.M. and A.M. at 45 Mc/s in respect of ingition interference are indicated in Table I. The first column shows the field strength of the wanted signal and the other columns show the distances at which a motor car must be for substantially complete inaudibility of interference under conditions of low ambient acoustic noise. It is concluded that in urban areas with frequencies around 45 Mc/s, a field strength of 5 mV/m would be needed for a practically noise-free service. With vertical polarisation some 15 mV/m would be necessary.

POLARISATION

Ground contours are the chief factors affecting propagation and the nature of the soil is not of great importance. It is necessary to site the transmitter on high ground, for hills cast shadows of low field strength and, in general, reception in valleys is less good than on high ground. The height of the receiving aerial is important and the field strength is approximately proportional to its height. In the BBC tests a receiving aerial height of 30ft. was used.

Frequency has an effect on all this and at 90 Mc/s the shadows cast by hills are more marked. The kind of variation that occurs is well brought out by Fig. 1, which shows the ground contour between Alexandra Palace and Woburn together with the field strengths actually observed. The smooth curve represents the ideal theoretical field strength.

It will be observed that the measured curve follows the ideal in its general trend but has marked variations. The effect of hills is well brought out; thus, at Dunstable a field strength of some 750uV/m is observed on high ground, but on the low ground just to the north it drops to around 50uV/m.

FADING

Fading does not usually occur at distances of less than 50 miles from the transmitter, but can be appreciable at longer ranges. The mechanism is different from that at lower frequencies and in general selective fading does not occur, there being only a more or less general variation of signal strength. It is brought about chiefly by changes in those conditions in the lower atmosphere which affect propagation. They are mainly temperature and humidity and they affect the amount of refraction which occurs. The latitude and the presence of land or sea beneath the transmission path also have an affect.

In addition, "bursts" may occur at ranges of over 100 miles. They last for a very short time and are thought to be caused by reflections from ionic clouds surrounding meteors. They are of no use, but may result in interference from distant stations.

Although selective fading as such does not occur, an analogous effect is observed when the signal can reach the receiver by two or more paths, such as by reflections from mountains or high buildings. It results in distortion, but is important only when the strengths of the signals from the different paths are of the same order and when the path difference exceeds about one mile.

Distortion of this type was noted on only one or two occasions during the trials and was eliminated by moving the aerial a few feet.

SERVICE AREA

It is difficult accurately to estimate the service area at high frequencies, but Tables II and III show what is expected. In these a first-class urban service is taken as needing a field strength sufficient to over-ride practically all ignition interference, and a second-class service, one with a field strength sufficient to override most of such interference. These are field strengths of 5 mV/m and 1 mV/m respectively, but in rural areas it is considered that fields of 200uV/m and 50uV/m are adequate for first- and second-class services.

It is interesting to note that the primary service area of transmissions on 90 Mc/s is rather greater than on 45 Mc/s, although the secondary service area is smaller. This is largely because of the lower level of ignition interference at the higher frequency.

An advantage often claimed for F.M. is the "capture effect," as a result of which an unwanted signal is suppressed by a stronger wanted one. It is often said that the latter must be only 6 db greater for the effect to be evident. The BBC tests show that it must be 10 db stronger to avoid intelligible interference, 20 db for a just tolerable level of interference and 30 db for its complete elimination.

With amplitude modulation and common-wave working 46 db is needed for substantially no interference when the transmitters are radiating different programmes, but 15 db when the programmes are the same. For a

second-class service this can be reduced to 10 db.

With common-wave operation and separate programmes, therefore, F.M. is about 16-20 db better than A.M. for a first-class service, but with a common programme the condition reverses and A.M. is about 15 db better than F.M.

QUALITY

So far nothing has been said about quality of reproduction, and many of the effects of propagation would apply equally to amplitude modulated transmissions. It is probably in respect of quality that the most absurd claims have been made for F.M. and it has often been boosted as as inherently high-fidelity system. This is largely because a comparison is made between a wide-band F.M. system on high frequencies and a narrow-band A.M. system on the medium waveband.

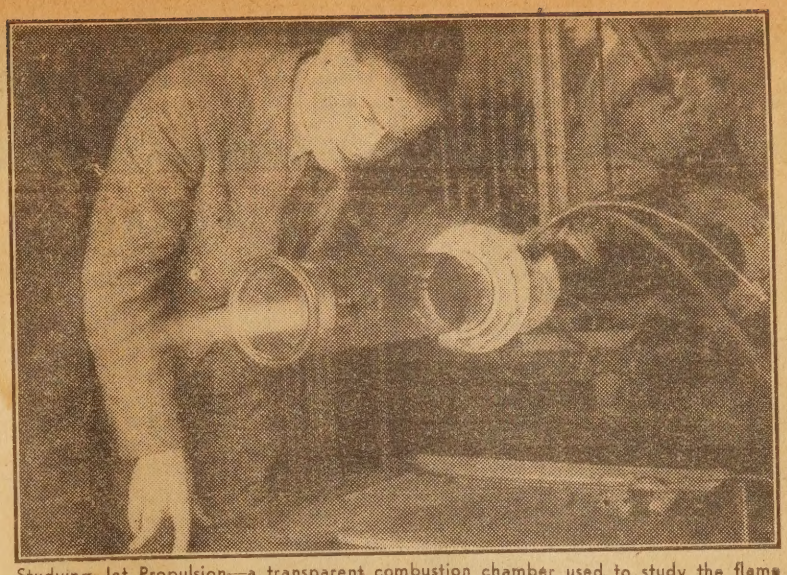
In the latter case the number of channels is so great that the avoidance of interference precludes the retention of modulation frequencies over about 4500 c/s, except in the immediate neighborhood of a transmitter where the field strength is sufficient to swamp interference. At high frequencies this limitation of bandwidth is not necessary and it is as practicable to transmit and receive as wide a band of modulation frequencies with A.M. as with F.M.

Taking a fair basis of comparison, therefore, there is nothing to choose between the two systems on the score of the audio-frequency response. However, considerations of receiver noise will dictate a decrease of band-width when the field strength becomes low. As F.M. gives a lower noise level than A.M., this means that the full bandwidth can be retained for greater distances from the transmitter and hence it can provide a greater service area in which a given standard of quality can be maintained. In this practical sense, therefore, F.M. can truly be said to lead to higher quality than A.M.

AMPLITUDE DISTORTION

Amplitude distortion can occur with F.M. just as with A.M. but in different ways. With the latter it occurs in the detector and through non-linearity of the pre-detector valves. With F.M. it occurs through an asymmetrical resonance curve and its avoidance demands not only a symmetrical resonance curve but precise tuning of the receiver. The attainment of this last may cause some difficulties with unskilled operators, and it is suggested that quartz-crystal control of the local oscillator might be a solution.

It is often said, too, that the fact that there is no upper limit to the modulation depth in the same sense as with A.M. permits a greater volume range to be handled. This is very closely tied to the signal/noise ratio, however, and is true only if the comparison be made for similar ratios at the minimum modulation depth. If advantage is taken of the improved signal/noise ratio of F.M. to increase the service area, then the volume range is not increased.



Studying Jet Propulsion—a transparent combustion chamber used to study the flame of an experimental British jet engine. Britain still leads in this field.

USE OF PRE-EMPHASIS

As used in the USA it is customary to employ pre-emphasis in the transmitter and de-emphasis in the receiver. This means that the A.F. response is made to rise with frequency at the transmitter and to fall with frequency by an equal amount at the receiver. In this way a further improvement in the signal/noise ratio is obtainable; a theoretical improvement of as much as 15 db has been claimed with a pre-emphasis circuit of 100usec time-constant.

In the BBC trials a 12-db reduction of receiver noise and a 6.5-db reduction of ignition interference was found. However, it became necessary to reduce the modulation depth, in some cases as much as 12 db, and more generally by 6.5 db. This reduced the gain through pre-emphasis to 5.5 db in the case of set noise and to zero for ignition interference.

With a time-constant of 50usec, receiver hiss and ignition noise were reduced by 7.5 db and 4.5 db respectively and called for a reduction of modulation depth of 3 db only. This made the true gains 4.5 db and 1.5 db. This value of time-constant is preferred to the American standard of 75usec and was used in the tests described earlier.

In addition to the measurements, comparative listening tests were carried out. Simultaneous transmissions of the Home programme were carried out from Alexandra Palace from 7 pm to 10.30 pm each evening from June 11 to October-10, 1945, the F.M. transmissions being on 46.3 Mc/s and the A.M. on 41.5 Mc/s. The F.M. power was 800 watts and the A.M. 1.5-2 kW and with a more efficient aerial. Vertical aerials were used.

DISTANT RECEPTION

Reports were received of reception up to 120 miles and all listeners able to compare the two transmissions were unanimously in favor of F.M. Some of them commented on the silent background of F.M. Car ignition interference was the most serious source of irritation and some listeners were disappointed with F.M. in this respect.

Later transmissions were made on 90.3 Mc/s with a power of 500 watts and the service was found satisfactory, in some cases being better than at the lower frequency.

An examination of pulse modulation was also made, but the conclusion was reached that F.M. is more suitable for broadcasting. The general conclusions of the BBC report are as follows:—

1. The use of ultra-short waves for broadcasting would relieve the present congestion in the medium and long wavebands as soon as a sufficient number of suitable receivers were in the hands of the public.

2. The use of frequency modulation on ultra-short waves would immediately and considerably extend the area of noise-free, high quality reception.

3. A reasonable number of frequency-modulated ultra-short wave transmitting stations could be arranged to provide a service throughout the United Kingdom.

4. The increased cost of a broadcast receiver incorporating an ultra-short-wave F.M. band is unlikely to be excessive. It seems probable that with suitable development the performance of F.M. receivers could be improved and the cost reduced.

5. It is thought that frequency modulation would be superior to pulse modulation for providing a high-quality broadcasting service in this country, even taking into account the possibility of using a multi-channel system, because pulse modulation requires a wider band width than frequency modulation to realise a given improvement in noise suppression over amplitude modulation.

6. For an ultra-short-wave F.M. service in this country, the following characteristics are thought to be optimum: maximum deviation, 75 kc/s; pre-emphasis, 50 usec; carrier channel spacing, 200 kc/s (400 kc/s between transmitters serving the same geographical area).

SCIENCE DOES WONDERS WITH WOOD

Lumberjacks sort out the raw material which has staged such a remarkable "comeback" in the sphere of constructional material.

The termination of the war in 1945 has given scientists an opportunity to do some stocktaking and make some effort to collate their achievements. Such a stocktaking was necessary since, during the war years, such a vast amount of scientific work was accomplished in various countries that it became necessary to find out what would be useful during the peace and what should be discarded.

THE result of this stocktaking is an imposing array of new ideas, devices, chemicals, food, building materials, fuel and so on. Many processes were in developmental stages, and these processes are still in course of investigation so that new schemes are continually being thrust onto a bewildered world.

BUILDING MATERIAL

It is therefore understandable that most people are beginning to think that whatever they own is already out of date or soon will be. They are afraid to build a house, because they read somewhere that new building boards and other materials are about to be thrust upon them which makes bricks as out of date as the Dodo. Of course this only applies to people who already have a house and are thinking of building another one. To those wanting a house even a tent these days comes under the heading of a "synthetic" home.

The fact of the matter is that scientists have given us so much that we are in a proper mess. We don't know where to start choosing or what to choose if we do start. We get a disease so that we can try out the new drugs and then find that those new drugs are not new although they were discovered only yesterday. Something else has been found—an extract perhaps from a new kind of mushroom.

We buy an article made from a plastic discovered last week, and tomorrow we find a shop window displaying a better article made from a better plastic discovered last night so to speak.

Only recently there appeared in the newspapers a report that production of a new aeroplane had been stopped in England because it had been superseded even while it was on the production line. So we go on and on. Where does it all stop? And how much money goes "down the sink" during this apparently chaotic march of progress?

Nevertheless there are some very interesting sidelights on the new ideas, and one of the most interesting is the new uses to which that very old constructional material, wood, has been put.

by Calvin Walters

WOOD LIKE STEEL

If, a few years ago, we had been told that wood would become as strong as steel, that we would be able to eat it, that artificial rubber would be made from it or that we could have a ding-dong party on the alcohol made from it, we would most probably have said "wooden it!" or "bark" out some other "pithy" saying to the big "sap" who told you. Maybe you would grab him by the "limb," "bough" him out of the house, and tell him to "leaf" you alone and "stem" his tall yarns. Smart today, aren't I? (That's a matter of opinion—Ed.)

However to get back to our story. Wood has been given such a face lifting that Noah would have had a wonderful time building a new Ark.

Wood is the oldest of structural materials, and until the invention of that much-used material known as "Masonite" (not meant for an advertisement), has remained the same ever since the beginning of things. Masonite departed from the usual, and made boards from pieces of timber which were exploded, and the resulting fibrous mass compressed into the now well-known building board.

UNIVERSAL MATERIAL

The vast improvement in chemical methods during the war has served to change the character of wood so much that German technicians engaged on research into the uses of wood called it "Universalrohstoff" which, translated into English, means Universal raw stuff.

One of the advantages to be gained from the improvements of wood is its renewability. Trees can be grown but iron ore cannot. Any nation can have about as many trees as it wants under a properly planned system of replacement, and providing some self-styled "town planners" are liquidated.

Perhaps it is hard to believe that wood can be made strong enough to

replace metals when strength and long life are required. You don't have to take my word for it. All you have to do is ask any scientist about the stuff called compreg. This is the story.

Plywood has been used for many years as a useful building board but it had certain disadvantages. The main one was its comparative uselessness as an outside material. Ordinary plywood depends for its strength on the laminations being glued together with the grain of one piece running across the grain of its neighbor. Placed in any position where moisture could enter the wood the plywood swelled and caused unequal stresses in the material so that on drying or shrinking it got out of shape or the laminations came apart or cracked.

IMPREGNATION

Scientists of the United States Forestry Service set about looking for something that would overcome the tendency of wood to shrink and swell. Impregnating the wood with resin and then heating it brought about the desired result. Further research brought about the discovery that the process made the wood plastic and thus it could be compressed into about a third of its original thickness. The resulting board has a hardness almost equal to mild steel and the process can be applied to pieces of wood of any shape or size.

The first part of the impregnating process — that of impregnating the wood with resins—results in a material which is being used for the manufacture of gears and bearings for machinery.

Compreg—which is "impreg" heat treated—is useful for nuts and bolts, plane propellers and decks of aircraft-carriers.

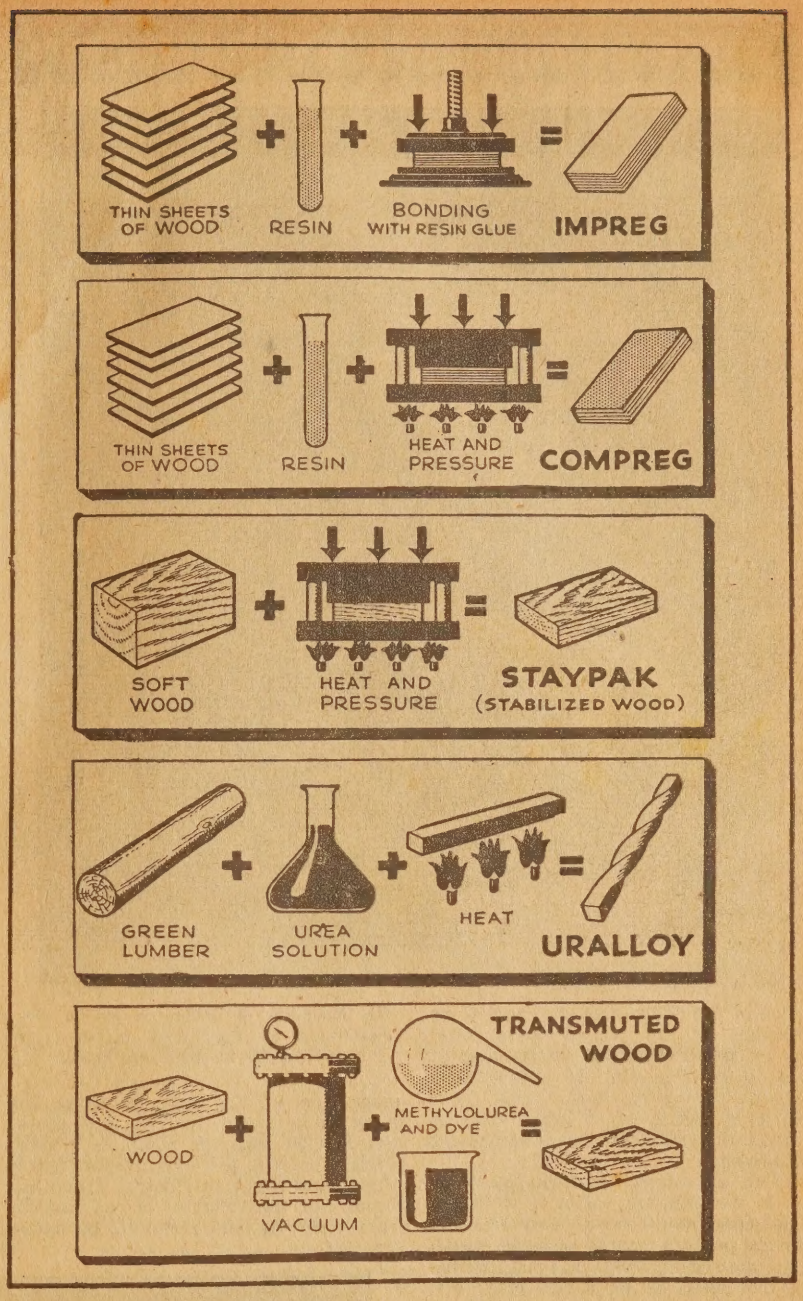
A new type of plywood has been developed which is formed into tubes and impregnated with phenolic resins. The tubes can be made from about ½ inch to 12 inches in diameter. The tubing will float and weight for weight will carry a greater load than steel tubing. A distinct advantage is the fact that the tubing can be worked with ordinary woodworking tools and can be threaded like steel. These tubes are being used for electrical conduits, lighting fixtures, rafts, musical instruments and torch cases, picture frames and air-conditioning vents.

URALLOY

Another important material called Uralloy is made from green timber which is soaked in a solution of urea. After drying it is heated to the temperature of boiling water. It can then be bent to any shape whatever. When formalin is added to the urea the wood retains any new shape permanently.

"Staypak" is another product of the American Forestry researchers. This product is made by subjecting wood to a simple process of heat and pressure. The method squeezes the air spaces out of the wood so that soft, weak woods are made into boards which have an iron-like toughness. Because no resins are used in the process, Staypak is not as brittle as Compreg or Impreg. It is almost twice as tough as Compreg and has a wide variety of uses from tool handles to gears, from mallet heads to plane propellers. It works well with metal working tools and can be highly polished.

One method of treating wood against shrinking and swelling is proving very successful. Strangely enough in this process the wood is passed through a bath of molten metal. The temperature is so high that the wood has to be entirely immersed in the molten metal, otherwise it would burn or char from the presence of oxygen. The resulting wood shows a reduction of 40 per cent. to the tendency to shrink or swell.

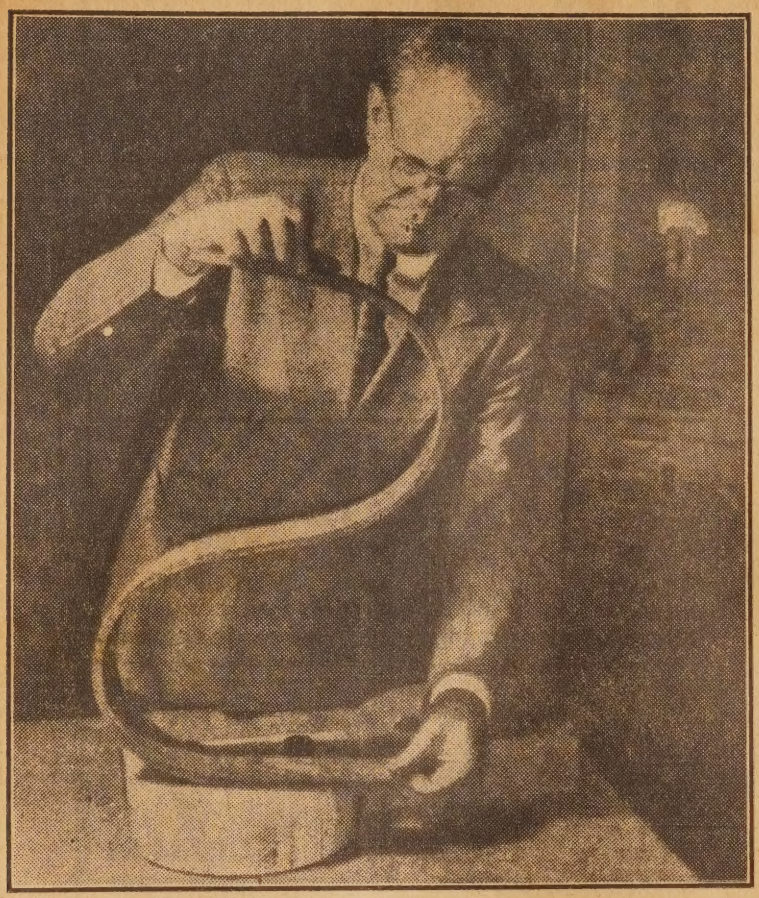


The above diagrams illustrate methods used in making various wood products. As will be seen, the three main factors employed are heat, pressure, and impregnation.

PLYWOODS

There is another important process for improving the weather-resisting qualities of wood. This makes use of new waterproof glues for joining wood together. Plywood made by this process is waterproof and weather-proof. During the war the British Mosquito bomber was made from plywood bonded with waterproof glue. Ships' keels and ribs and small boats were also made from it and today it is being extensively used for caravans and in any construction exposed to water and weather.

WOOD PRODUCT SHOWS FLEXIBILITY



The flexibility of uralloy is clearly demonstrated by the above picture. It can literally be tied into knots.

One of the difficulties that had to be overcome in the use of these glues was to obtain sufficient penetration of heat to set the glue in the interior portions of the plywood. This was solved by using short wave heating generation while the wood was under compression.

There are almost limitless possibilities in the breaking down of wood into its component parts. For this the starting point is usually cellulose which is the main component of wood. Cellulose can easily be made into sugar, but this is not an economical proposition for use in the kitchen as cane and beet sugars can be made much more cheaply.

In the chemical industry however, unrefined wood sugar has a very important place. The Germans have been making industrial alcohol from wood sugar for some years, but the process has recently been vastly improved in America. A plant in the USA has a capacity of over twelve million gallons a year of alcohol. From one ton of softwood is made sixty gallons of alcohol, and eventually it is hoped to bring this yield up to about 90 gallons per ton. The alcohol is used as a high-grade motor fuel, and there is hope here for the thirsty traveller to take advantage of the idea of using his drink as a motor fuel or vice versa. Mixed with radiator water it should prove a boon to lost car drivers on the new rocket range in Central Australia. Reports of the behavior of the rockets from such travellers should be spectacular!

Synthetic rubber manufacture requires large quantities of alcohol, so that here again the importance of wood is growing.

Wood can be made into an article of diet by growing yeast on wood sugar in the presence of nitrogen. The resulting yeast has a high protein value.

Lignin is the substance that cements and surrounds the cellulose fibres in wood. This substance is obtained as a by-product in the manufacture of wood alcohol and appears as a brown colored powder. Chemists have made Lignin yield its quota of usefulness in the form of phenols and cresols and many other important chemicals.

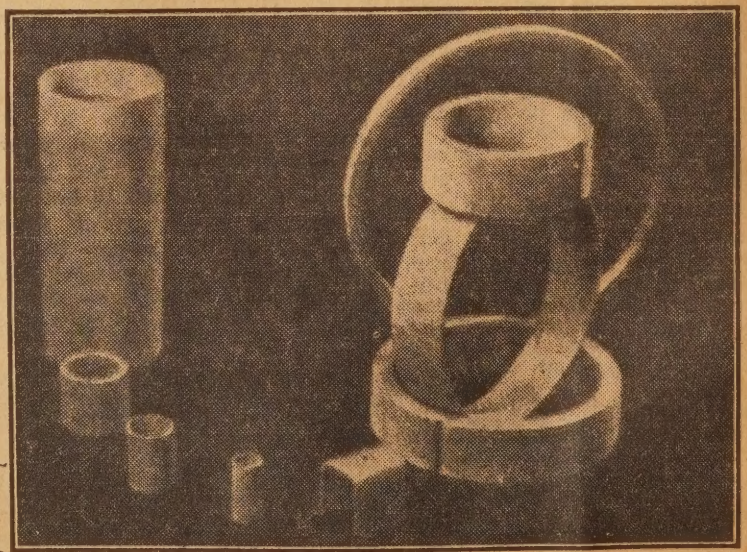
As phenols and cresols are used in the plastics industry, it follows that the production of these chemicals from the by-products of the manufacture of wood alcohol is a useful addition to the already heavily taxed chemical industry.

The impregnation of paper with a wood substance called papreg introduces another possible building material. The impregnated paper can be pressed together and formed into sheets of great strength.

Transmuted wood is the name given to another wood product of the USA Forests Products Laboratory. Ordinary untreated wood is placed in a cylinder and the air then exhausted. A solution of methylolurea is now forced into the chamber and when the wood has been impregnated with the chemical under pressure the wood is removed and dried.

Soft woods under this process assume a hardness greater than ebony, and color can be applied to the wood by mixing a dye with the impregnating chemical. Transmuted wood is very heat resistant and warp resistant. An oxy acetylene torch takes almost twice the time to cut through a piece of this wood than through a piece of steel of equivalent dimensions.

The possibilities of the new processes are limitless. When it is realised that of every tree felled at the present time for use as building material, only about a third is of any value under the old processes, it can readily be seen what waste will be avoided by adopting the new wood treatments.



Although it is light enough to float, tubular plywood can support a greater load than can steel tubing.

LARGE SCREEN SETS FOR TELEVISION

DEVELOPED by American technicians during the later stages of the war, the new type of layout makes possible a viewing screen 21 inches by 16 inches.

This large-screened home television set was first exhibited early in 1945. It was modelled by the Radio Corporation of America, with the co-operation of the National Broadcasting Company.

It is possible to enjoy picture projection in all its details from a distance of 18 feet or so.

SPECIAL REFLECTOR

The increased size of the screen is made possible by a reflective optical system, which delivers to the viewing screen about six times the light that is delivered from receiving tube to screen by a conventional movie projection lens without loss of quality.

A new high-voltage type of cathode-ray tube increases brilliance in the scene. A brilliant image on the face of the cathode-ray is projected on to a spherical glass mirror, then reflected up through the correcting lens of moulded plastic on to a flat mirror, which throws a focused image on to the translucent viewing screen.

The new layout is thus a real improvement on the old system, in which a direct-viewing cathode-ray tube 12 inches in diameter emitted rays on to a screen of about 9 inches by 7 inches.

Television is now a practical reality in Britain and the USA, where regular programmes are televised.

Britain before the war lead the world in television. Secrets were made available to the USA as part of the wartime pooling of information useful to the common war effort.

ELECTRONIC SYSTEM

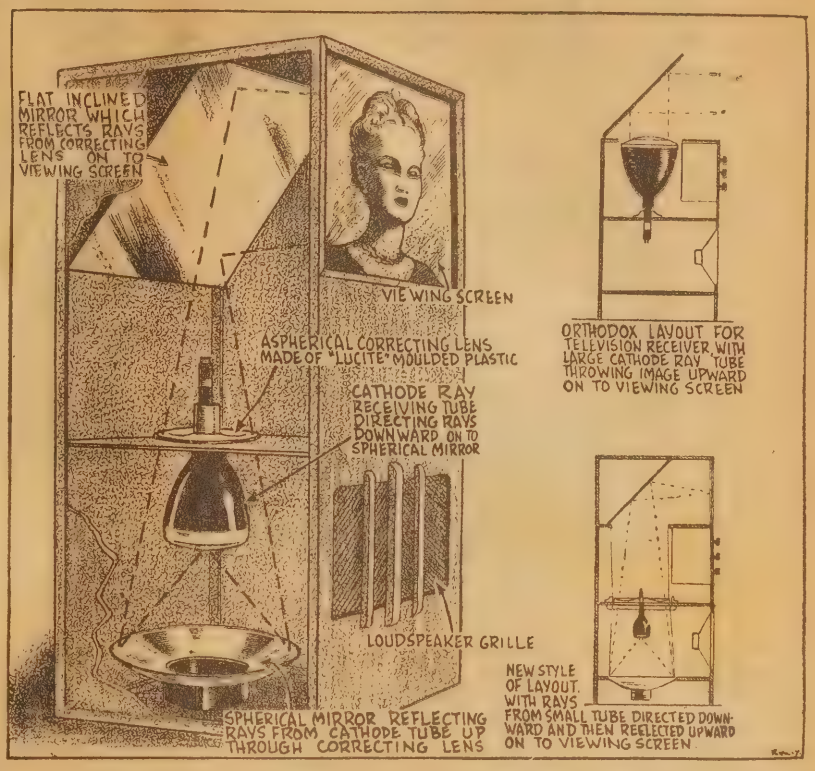
Television is one of the remarkable processes based on electronics—or the science of controlling the tiny, electrically-charged particles basic in every kind of matter. In the electron television camera there are mechanically-moving parts.

The scene to be transmitted is focused through a lens system on to a sensitive plate, which is a photo-electric moisaic composed of a mica plate at the front and a metal plate at the back. Minute differences in potential are created between the mosaic particles on the mica plate according to the color predominating in each particular scrap of the picture, and electronic "messages" are produced accordingly. The signals are produced in sequence, left to right, top to bottom, by the scanning action of a beam.

THE MOSAIC

The camera thus breaks the scene into thousands of pieces, which are transmitted one "piece" at a time. After a synchronising impulse has been added to the picture signals are radiated as radio waves.

In the receiver the processes are reversed. In the cathode ray tube an electron beam is directed in perfect co-ordination with the electron beam in the camera tube. Exactly he same number of electrons are sent to each point of the screen in the receiver as was on each point of the screen in the camera. The electron stream is directed so that it keeps time with the movements of the scanning spot in the camera, each covering the whole surface 30 times each second.


FLAT INCLINED MIRROR WHICH REFLECTS RAYS FROM CORRECTING LENS ON TO VIEWING SCREEN
VIEWING SCREEN
ASPHERICAL CORRECTING LENS MADE OF "LUCITE" MOULDED PLASTIC
CATHODE RAY RECEIVING TUBE DIRECTING RAYS DOWNWARD ON TO SPHERICAL MIRROR
LOUDSPEAKER GRILLE
SPHERICAL MIRROR REFLECTING RAYS FROM CATHODE TUBE UP THROUGH CORRECTING LENS
ORTHODOX LAYOUT FOR TELEVISION RECEIVER WITH LARGE CATHODE RAY TUBE THROWING IMAGE UPWARD ON TO VIEWING SCREEN
NEW STYLE OF LAYOUT WITH RAYS FROM SMALL TUBE DIRECTED DOWNWARD AND THEN REFLECTED UPWARD ON TO VIEWING SCREEN

An interesting new layout in television receivers has been made possible by the production of an aspherical correcting lens made of moulded plastic. The new layout makes possible a much enlarged viewing screen without increase in the size of the whole receiving set.

RECORDING ON PAPER

Magnetic recordings of radio programs, and messages for mailing to distant points are being made available in the United States on a new medium—a paper tape coated by a printing process with a thin film of magnetic material.

The development of the paper tape technique is an outgrowth of forward strides made during the war in magnetic recording on a thin steel wire. The paper tape is about 0.003 inch thick and comes on a reel like that used on eight-millimetre home movie equipment.

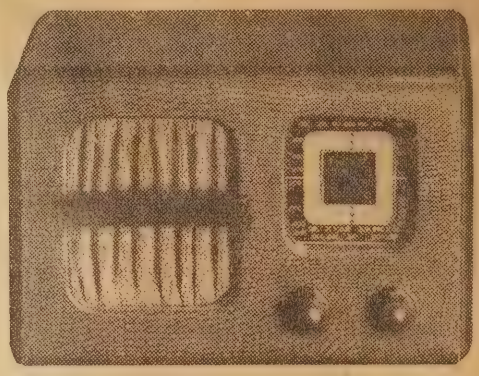
It passes from a supply reel to a take-up reel through a magnetic recording head. Variations of the sound-modulated electrical energy are transformed by the head into magnetic variations in the paper coating.

One of the advantages of the paper tape is that it can be cut at any point and a portion of the tape deleted. Splicing of the cut ends of taps is easily accomplished with an adhesive.

Recordings can also be magnetically erased, in full or in part; this permits re-recording of new programmes or sound, or adding material between wanted portions. The tape is expected to give a useful life in excess of that of the usual disc recordings.

The first model of the paper-tape magnetic recording instrument, a product of the Brush Development Company, will be about the size of a table-top radio and is planned to be an accessory to the present home radio receiver. Each full reel of paper tape will accommodate a half-hour of recorded material.

"First with the BEST!"



"Tiny Tim" EDMACO, 4 Valve broadcast mantel radio, amazingly small (9 x 6 x 6), full size parts and performance, list price £17/19/6. Trade supplied. Complete kit-sets also available, prices on application.

"Palsy-Walsy" EDMACO, 4 valve battery portable radio, self aerial, also external terminals. Pretty-pretty cabinets, light weight, using new Eveready Minimax batteries, with life of over 150 hours. Take "Palsy-Walsy' everywhere. List price, £22/10/-, complete. Trade supplied. Kitsets also available, prices on application.

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Technical Review

RADIOTRON 4-VALVE REFLEX

The latest issue of "Radiotronics," number 120, contains details of a very interesting four valve superhet. circuit suitable for mantel or table model receivers. The circuit is reproduced below, together with a precis of the descriptive article.

THERE is a consistent demand for small 3/4 valve receivers, which almost invariably employ a superhet circuit. The usual "straight" superhet of this type has a sensitivity of about 300 microvolts, which is scarcely adequate under difficult reception conditions. In seeking higher sensitivity without the use of additional or unusual valves, the reflex principle has obvious attractions.

However, reflexed circuits have generally exhibited undesirable qualities, notably the tendency for the reproduction to be very distorted when the volume is turned down to a low level. There is a tendency also for the I.F. amplifier to overload, due to the reduced operating voltages on plate and screen and to the limited A.V.C. action on strong signals.

The new Radiotron circuit minimises these effects by using an audio load of only 15,000 ohms in the plate circuit of the I.F. amplifier, which does not so drastically reduce the plate voltage. Nevertheless, the high transconductance of the 6SF7-GT permits an audio gain of 12.5 times under these conditions. The effect of this on sensivity is marked, but the detector and volume control circuit functions in a much more normal manner.

In conformity with recent Radiotron practice, the I.F. amplifier stage employs neutralisation to ensure complete stability, despite the high gain I.F. amplifier valve. The neutralising capacitances Cn1 and Cn2 are quite small, being actually 5 turns of 26 gauge enamel wire wound over the end of an insulated lead.

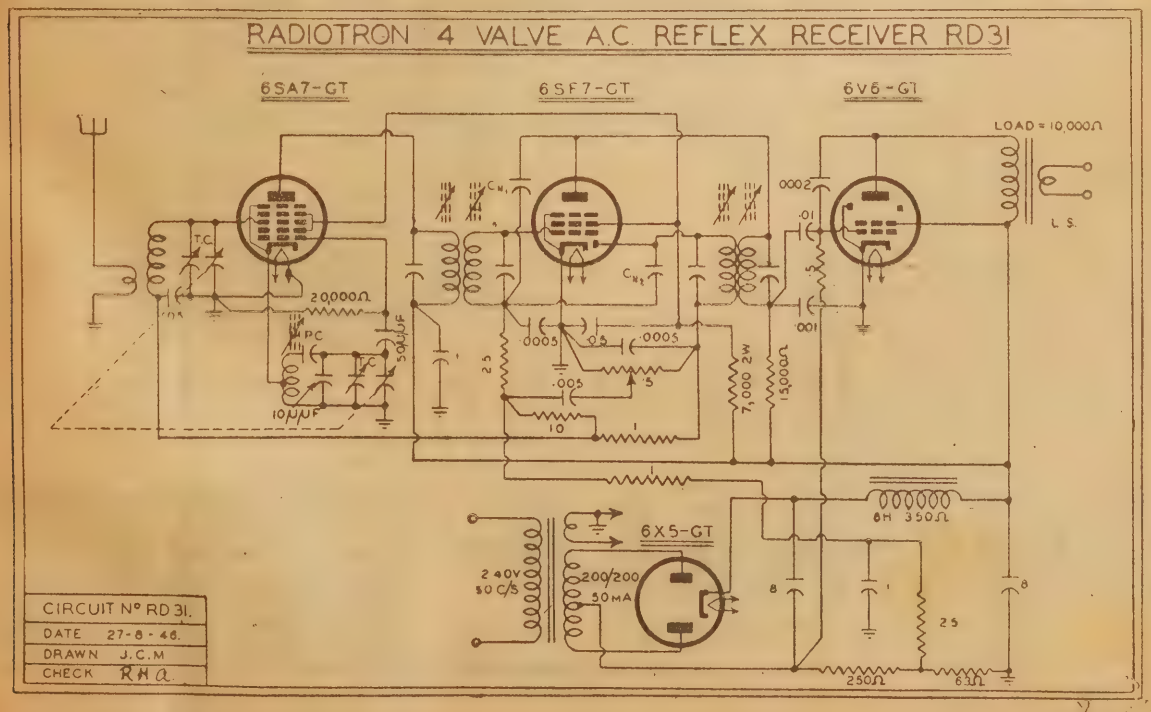
Only a small portion of the A.V.C. voltage is applied to the grid of the 6SF7-GT, since the controlling effect is apparent for both the I.F. and audio signal voltages. The ultimate control afforded by the arrangement is very satisfactory for a small receiver of this type.

A 6SA7-GT is used as the converter valve, with a tapped oscillator coil. The padder condenser is placed in the "hot" side of the tuned circuit, the oscillator voltage from cathode to earth is higher at the low frequency end of the band. Sample coils were tested in the receiver from R.C.S. and Aegis, both giving satisfactory results.

The power valve is operated with low plate and screen voltages to reduce high tension requirements and heating effects in the cabinet. The power output for reasonable distortion is slightly over one watt, which is ample for the small speakers and cabinets.

The measured test results show an effective high tension voltage of about 185, with a high tension current of just over 40 milliamps. Sensitivity at the aerial terminal is 51 microvolts at 600 kc., microvolts at 1000 kc and 39 microvolts at 1400 kc.

The selectivity curve shows the bandwidth to be 72 kc. at 1000 times down. This is wider than usual but is accounted for by the fact that the I.F. transformers used were of relatively low "Q." The absence of regeneration, due to neutralisation, also has an important effect.



"UNIVERSITY"

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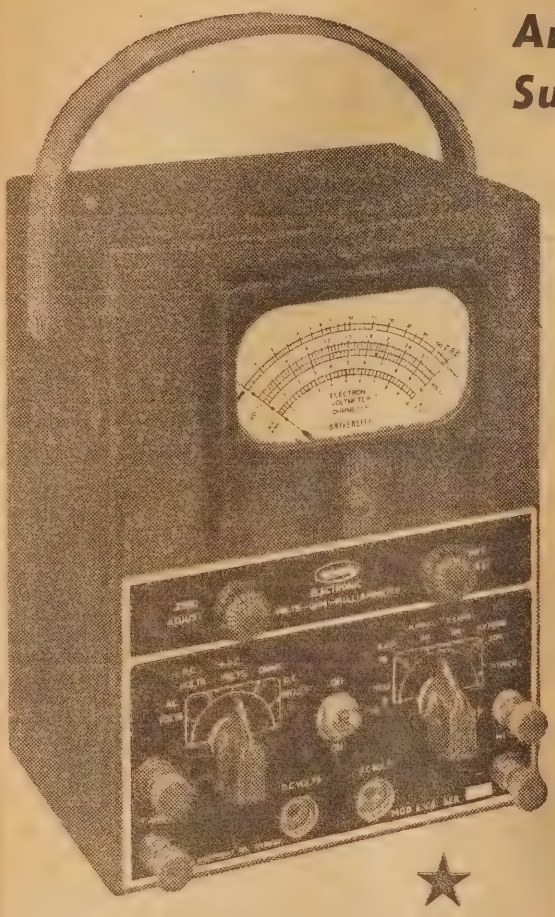
"VOLTMETER"



The new University Vacuum Tube Voltmeter is an instrument designed specially for the radio serviceman and experimenter. It covers D.C/A.C. output volts and milliamps to 1000 and ohms to 1000 megohms Bridge circuit with inverse feed-back assures stability. Input resistance on all D.C. ranges, 11 megohms, and on all A.C. ranges 1 megohm.

The instrument operates from 240 volts A.C.—write today for descriptive literature.

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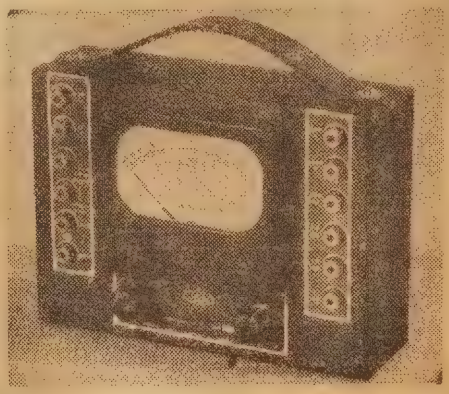
University Multimeter Kit

(MODEL MKI)



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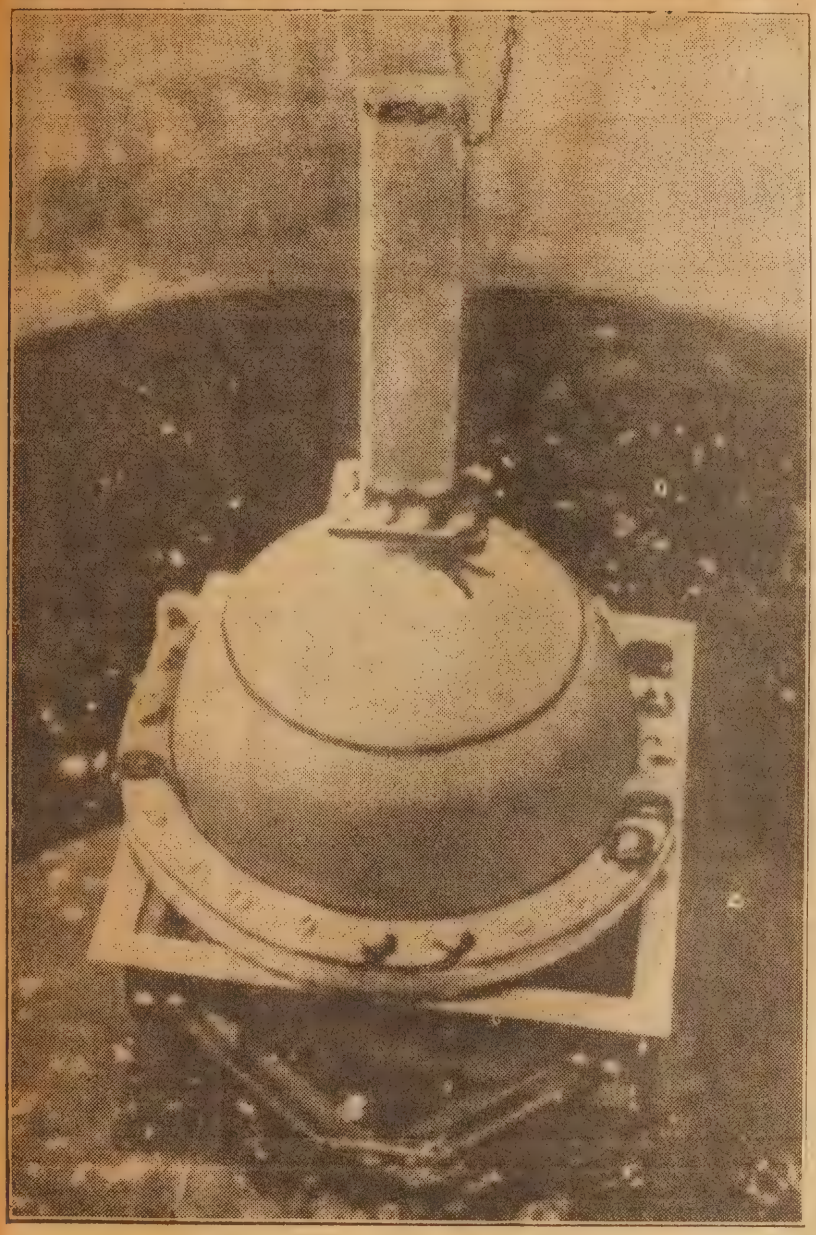
GERMANY'S ATOMIC BOMB EFFORT



This device contained 1200lb. of uranium in paraffin—occupied a water-filled pit.

From "Science Illustrated" comes this picture and comment on Germany's effort at making an atomic bomb.

WHAT the Germans were doing about nuclear fission and atom bombs—a question that had our own scientists in a sweat for four years—is fully answered by this photograph, taken from a German secret document and published here for the first time. Made in 1943 in a Berlin underground laboratory, they show an attempt at a self-sustaining chain-reaction pile, such as our scientists achieved at Chicago in 1942. For us the pile was a step toward a bomb. The Germans intended their pile, which they called a "uranium engine," to be a kind of bomb itself, though American scientists are not sure how it was meant to be used.

Only in recent weeks has information about the German experiments been released even to scientists on our atomic project. Understandably miffed, scientists blame the Army's secrecy rules.

MICRO-WAVE TELEVISION PICKUP

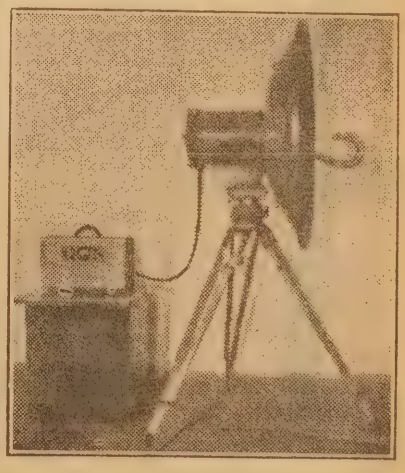
Television pickup relay apparatus capable of relaying signals from the pickup point to a television transmitter within a 15-mile range, was announced recently by the Radio Corporation of America.

THIS new radio relay equipment produces a frequency-modulated signal with approximately 100 milliwatts of power for the picture carrier. The band width permits reproduction of the finest detail in the camera picture. It operates at any selected frequency in the 6500 to 7050-megecycle band.

The use of a highly directional parabolic transmitting antenna provides a signal gain of about 5000 times, with a 4-foot reflector, or 11,500 times with a 6-foot reflector, thereby providing an equivalent power of 500 or 1150 watts, depending on reflector size, in the direction of the receiving antenna.

To obtain this high gain, a hook-shaped wave guide literally pours power into the focal point of the saucer-like reflector, much as the filament in an automobile headlight sends its light to a concave reflector for intensification.

The same principle is employed at the receiver unit, where the parabolic reflector receives the signal and concentrates the beam into a wave guide to add another gain of 5000 to 11,500 times. The total effective signal gain from the transmitter waveguide to the receiver waveguide is therefore approximately 25,000,000 times with the smaller reflector or 132,250,000 times with the larger one.

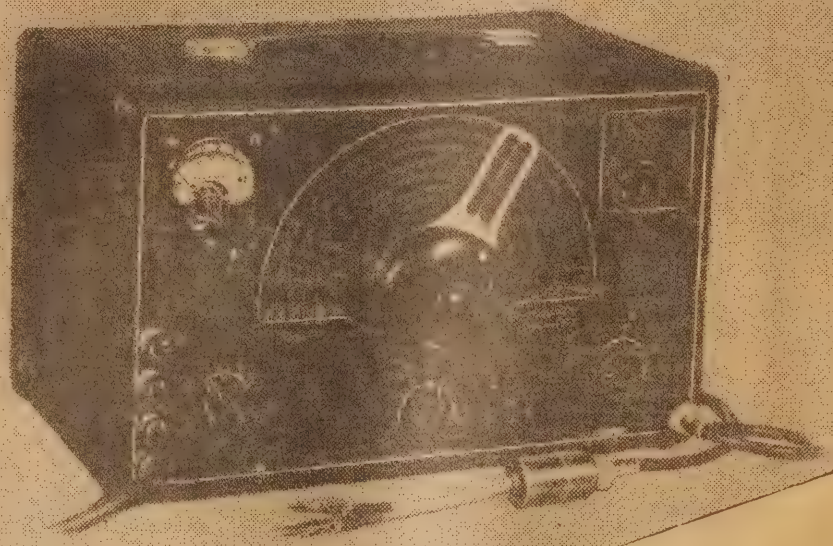


The transmitter is mounted in the cylinder immediately behind the parabolic reflector.

ANNOUNCING

The Palec Modulated Oscillator

MODEL MO1



THE newly released "Palec" Modulated Oscillator Model MO1 has been developed to cater for the exacting requirements of up-to-date radio servicing.

Many of the essential features developed for our factory type Signal Generator Model S.G.1 have been utilised, resulting in a robust and reliable instrument with a performance unexcelled in its price field.

SPECIFICATIONS

The unit comprises a Colpitts oscillator covering the range 150 K/cs.-30 M/cs. in six direct reading bands. The coils are permeability tuned . . . Calibration accuracy 1% . . . Dial is a vernier type of 54:1 ratio . . . The output of the oscillator is fed to a cathode follower stage to overcome frequency modulation and attenuator reaction . . . 400 C.P.S. modulation is fixed at 30% . . . An unprecedented feature is the attenuator, a heavy cast machined unit of Signal Generator pattern which provides attenuation within ± 1 db in five steps with an impedance of 11 ohms on the lower settings . . . Triple shielding ensures leakage less than 0.5 microvolt at all frequencies . . . Approximate output voltage is from less than 1 to 100,000 microvolts . . . Power supply 210-270 volts A.C., 40-60 C.P.S. . . . Supplied complete with detachable dummy antenna, co-axial leads and 24-page instruction booklet. Dimensions: 14" x 8¾" x 8½". Weight: 26 lbs.

Available in two models: MO and MO1, the latter having a built-in 3-range A.C. output meter for alignment purposes. External vibrator unit for battery operation extra. "Palec" Signal Generator Model S.G.1, as supplied to and used as standard production test units by leading radio manufacturers, also available.

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NEWS AND VIEWS OF THE MONTH

Amateur Power Limits

THERE are undoubtedly many matters included in the PMG's regulations governing amateur transmitting badly in need of revision. Among these, one of the most urgent concerns the power limits in force at the moment.

The holder of a "B" class licence is allowed an input of 50 watts, and the holder of an "A" class licence is allowed a 100 watts input. Apart from the desirability or otherwise of two classes of licences, we consider that restrictions requiring less than 100 watts input are causing, and will cause, so much misunderstanding and heartburn to all concerned, that the Department would be wise to remove them altogether.

A 50 watt power limit is a very awkward thing. It is safe to say that for convenience of design, efficiency and economics, the average amateur finds an input of about 75 watts a workable optimum. The holder of a "B" class licence, as a rule, is unable to build equipment limited to 50 watts input using components which will readily allow him to increase power, later on to the full 100 watts. He is therefore faced with the necessity of extra expenditure on receipt of his "A" class licence, or breaking regulations now by using components which enable his transmitter to be operated in excess of 50 watts.

INTERFERENCE

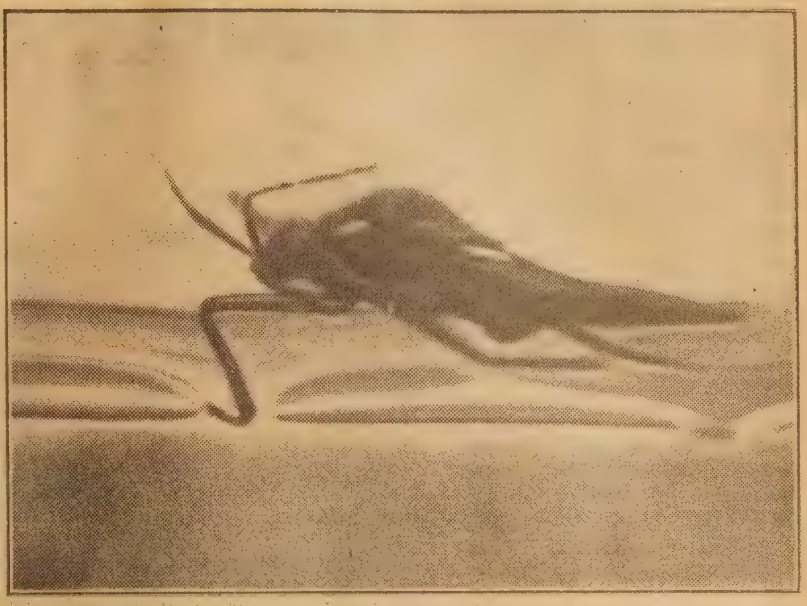
The only argument against a flat limit of 100 watts would appear to be the danger of local interference by new amateurs. If this objection is valid, there is an equally good argument against allowing any amateurs to use 100 watts, bearing in mind that there are a large number holding "A" class licences. In actual fact, however, the increase from 50 to 100 watts represents a mere 3 D.B., an effective increase easily exceeded by the use of directional aerials in place of extra power.

It is unlikely that interference problems would become serious until the power used was increased to something like 500 watts, a figure far in excess of that used by any licensed amateur.

ONE-CLASS LICENCE

We suggest to the Department that by eliminating altogether the two classes of licences, and allowing all licensees to use 100 watts input, they would automatically eliminate a large number of contentious matters now embarrassing not only themselves but the amateur movement in general. It is very difficult to visualise any legitimate reasons why this should not be done.

Moreover, the regulations covering the use of power and components are so badly worded that they are incapable of adequate enforcement. Such regulations do not encourage respect for those that are.



REMARKABLE POPULAR SCIENCE PICTURE.—Using a miniature camera equipped with a special focusing attachment, Russian-born Nature photographer Roman Vishniac, obtained this remarkable insect close-up. His subject is known to entomologists as "Velia" and to non-scientists as the "water strider" or "pond skater" because of its mode of locomotion. During the warm months, it is found racing across the surface of shady pools. How this curious insect manages to walk on water has mystified generations of rural youngsters—and their elders. The explanation lies in surface tension, a phenomenon which appears to give water, and all other liquids, an invisible, elastic "skin." Removed from the water, Velia can only make short, frustrated leaps. It has adapted itself so completely to life as an aquatic pedestrian that it cannot handle its ungainly body on dry land.

U.H.F. Records Broken

A FEW weeks ago, 6-metre signals from an amateur station located in Victoria were received for a short period in Sydney and Wyong at excellent strength. This is the first time that signals on these frequencies have been heard in Australia over such distances. Amateurs are naturally delighted with their success after so many years of patient listening for just such an event.

While this fact does not imply the probability of regular contact on U.H.F. on an interstate basis, it does serve to draw attention to this highly interesting and important phase of amateur activity. During the war, signals were received on various types of communication and radar equipment over several thousands of miles, on many occasions when meteorological conditions were favorable. Such conditions appear to have existed to allow the six metre record mentioned above, to be set up. We sincerely hope that it will serve to excite the interest of greater numbers of amateurs to explore this U.H.F. region, as there are many further fields to conquer, and many other frequency bands with which to do it.

Fighting Bushfires

PROGRESS is being made by the Bushfires Advisory Committee in its efforts to create an emergency radio network operated by local Councils for the purpose of fighting bushfires.

Demonstrations in the various Shires are in the process of being organised, and some of these have already been carried out. The Committee is in a position to supply radio transmitters and receivers from surplus army stocks to form a basis of such a network. Many Councils have already ordered some of these sets and efforts are being made to supplement them by obtaining highly mobile "walkie-talkie" equipment as well.

Licenced radio amateurs, under the auspices of the Wireless Institute of Australia, are co-operating with the Councils in the maintenance and operation of such equipment.

AIR SUPPORT

While these arrangements are calculated to enhance greatly the efficiency of ground parties in fighting bushfires, there still remains the problem of more efficient observation of such fires than can be effected from the ground.

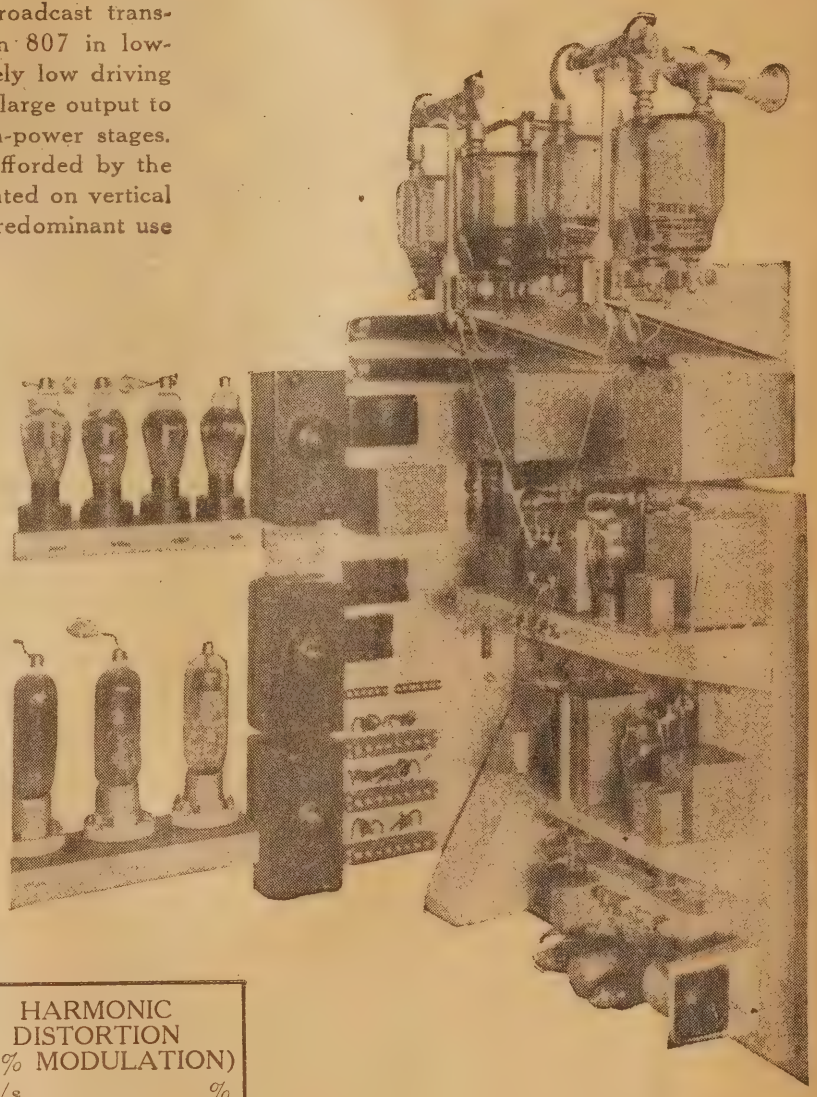
The use of helicopters for this pur-

2000 WATT BROADCAST TRANSMITTER

THE design of A.W.A. broadcast transmitters features Radiotron 807 in low-power stages needing extremely low driving power to produce a relatively large output to feed to the input of the high-power stages. Apart from the accessibility afforded by the respective sections being mounted on vertical chassis, A.W.A. feature the predominant use of 807's in a-f circuits.

Because the cathode follower circuit precedes the modulator and approximately 16-18 db of negative feedback is used, an extremely low noise level has been achieved. Negative feedback is applied from the anode circuit of the modulator stage to the grid circuit of the No. 1 speech amplifier. The 807 cathode follower valves are operated as pentodes, with screens at the same a-f potential as the cathodes through the use of a unity radio transformer and large screen-cathode capacitances. A further two Radiotron 807 valves are used in the Crystal Unit.

During acceptance tests of a recently completed transmitter, the following figures were realised:



FREQUENCY RESPONSE (50% MODULATION)		HARMONIC DISTORTION (95% MODULATION)	
c/s	db	c/s	%
30	—1	50	2.4
50	—0.3	100	1
100	0	400	0.9
500	0	1,000	1
1,000	0	5,000	2.7
2,000	+0.2	7,500	3.1
4,000	+0.5	NOISE LEVEL (BELOW 100% MODULATION)	
6,000	+0.3		
8,000	—0.2		—68 db
10,000	—1.3		

SPECIFY...

THE WORLD'S STANDARD VALVE

Radiotron

MADE IN AUSTRALIA

Advertisement of Amalgamated Wireless Valve Company Pty. Ltd.

pose would appear to be a particularly logical and suitable idea, particularly where an outbreak threatens to become serious. Radio communication between helicopters and ground control stations, relayed to individual fire fighting parties, equipped with "walkie-talkie" apparatus, should produce results far exceeding those possible at present.

Once the value of radio communication has been demonstrated by the use of the equipment now available, it is to be hoped that the way will be open for a State-plan network, using modern radio equipment specifically designed for the purpose of operating in conjunction with air support.

The enormous saving to the community in life and hard cash would, we are convinced, far exceed the first cost of such a scheme. It is to be hoped that some plan of this nature will begin to take shape in the very near future.

★ ★ ★

Price of Radio

MR. R. J. W. KENNELL, President of the Radio and Telephone Manufacturers' Association of NSW, has reported in a local trade journal, "Radio & Electrical Retailer," as follows. He was commenting on the recent budget as presented to Parliament by the Prime Minister:—

"The Excise impost of 1/9 per valve, plus a war loading of 2/- per valve, remains unaltered by the Tariff Revision. Practically every valve used in Australian-made radios is locally-manufactured, and consequently the reduction of 10% duty on valve imports will not benefit the radio listening public of Australia. It is true that radio valves are exempt from Sales Tax (10%), but in lieu thereof, the collective imposition of Excise and War Loading (3/9) plus mark-up, represents an unjustifiable indirect tax of approx. 50% on the purchase price of radio valves.

"Further, when a listener purchases a second set, he has to pay an additional fee of 10/- per annum. Why a person should have to take out more than one licence for one residence is also hard to understand. Rarely, if ever, would two or more radio sets be operating simultaneously in the one home, so the period of inactivity of each set would almost be doubled where the listener owns two sets."

Mr. Kennell could scarcely have stated the case better. One feels that the whole position of valve prices in Australia and the factors operating to keep them at their present high level are due for a review.

KEY COMPONENTS

In most mechanical and electrical devices we generally find one, or perhaps two, components so essential to their operation as to place an enormously powerful controlling influence in the hands of those responsible for their production. The impact of the valve industry on receiver design, production and over-all cost of radio receivers, has no parallel. Even the importance of the loudspeaker cannot compare with it. Consequently, as Mr. Kennell has pointed out, the cost of radio valves to the public is something which goes far beyond a mere transaction between buyer and seller.

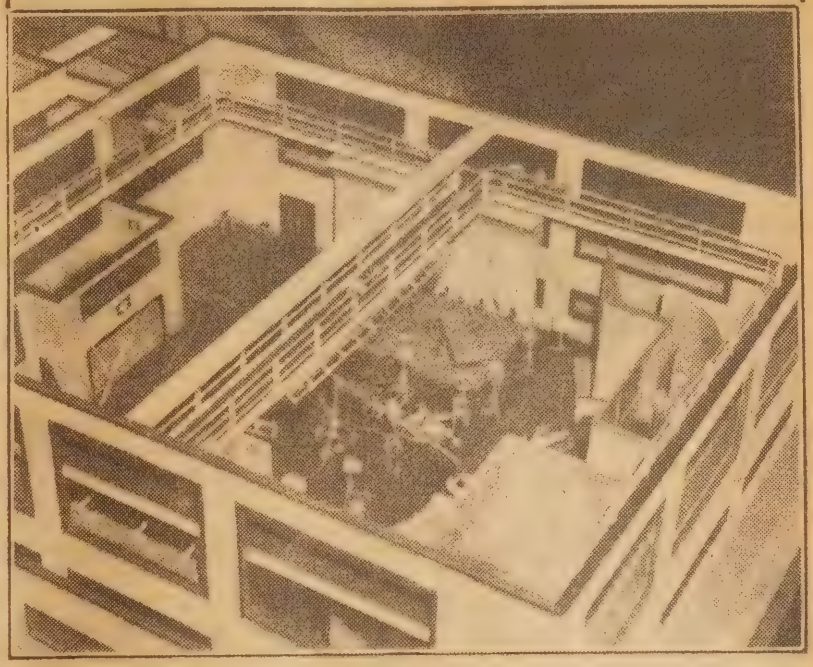
Radio is now part and parcel of our daily lives, and possesses the full importance of any other necessity. As a result, the Government and the community at large should be assured that if the requirements of private enterprise in manufacture are satisfied, no other factors operate to keep valve prices one penny in excess of the price the public should be asked to pay.

LICENCE FEES

The same comment is applicable to the matter of licence fees. Their imposition should not be allowed to be an easy method of adding to consolidated revenue or to maintaining what is virtually a Government controlled radio network on a scale more elaborate than is absolutely necessary.

It is vital to almost every aspect of our daily lives that a good radio service should be available to the community without the shadow of financial exploitation by anybody, Government or privately owned. We agree with Mr. Kennell in his considered statement that the cost of both radio valves and licence fees are matters which are due for a close and stringent review.

EXHIBITION AT SCIENCE MUSEUM



In their plans to give increased attention to electronic equipment, the Sydney Museum of Technical and Applied Science has recently set up a display of television equipment. Largest exhibit is an exact scale model of the new Alexandra Palace studios, headquarters of BBC television activities. The model shows the layout of the main and secondary studios, control rooms, film pickup rooms, theatrette and all auxiliary installations. The above picture shows just one corner of the main studios. Other exhibits include a working model of the early disc television system, a demonstration of the effect of a magnetic field on a cathode-ray beam and a collection of large pickup and picture tubes. Also on display is a complete English HMV television receiver employing a total of 19 valves. Using a 14 inch cathode-ray tube, the receiver produces a picture measuring 11⅛in. x 9⅜in.

Receives Fellowship

FELLOWSHIP of the Institution of Radio Engineers Australia has been conferred on Dr. Edwin Howard Armstrong, Professor of Electrical Engineering, Columbia University, New York, USA, in recognition of his outstanding contributions to the progress of radio science over many years.

Dr. Armstrong was born in New York City on December 18, 1890, and graduated in the degree of Electrical Engineering at Columbia University in 1913, whilst in 1915 he was awarded the Trowbridge Fellowship.

In the field of invention he may be regarded as the greatest single contributor in the development of modern radio. His inventions include the well-known Regenerative Circuit 1912, Superheterodyne method of reception in 1918, Super-Regenerative Circuit in 1920 and in 1933 his well-known system of Frequency Modulation.

It is interesting to record some extracts from the citation which accompanied the award of the Edison Medal for 1942 to Dr. Armstrong. The Edison Medal was founded by the associates and friends of Thomas A. Edison, and is awarded annually for "meritorious achievement in electrical science and electrical engineering or the electrical arts" by the Committee consisting of twenty-four members of the American Institute of Electrical Engineers.

Battery Version

Little Jim 2

Little Jim 2 here appears as an all-battery operated job, preserving all his attractive features of low cost and simplicity. He has already proved himself a staunch performer.

LAST month, we described Little Jim 2. a new version of the baby receiver for headphone reception of broadcast stations which made its highly successful bow just before the last Test matches were played in England.

There was nothing sensationally new about the circuit—being in fact standard as far as the use of a twin triode valve for detector and audio amplifier is concerned. It was the handy form in which the set was made up which played such a big part in its attraction for beginners in radio, for anyone looking for a small, headphone set.

TEST MATCHES

We thought that the advent of the present Test Matches would raise once again the possibility of using such a set for handy headphone listening, where a regular radio is not available. In this we appear to have been correct, judging by the number of people round about the office, who have offered to buy the original from us with all kinds of bribery as an inducement!

PARLIAMENT

There is another aspect on the use of such a set. and that is that many these days listen to the parliamentary broadcasts, much to the disgust of other members in the household who are much more interested in Jack Davey or the local Symphony concerts.

For such people, Little Jim is an ideal proposition, being easy to make, low in cost, and quite inexpensive to run.

Moreover, the use of headphones means that the listener is able to concentrate on what he is hearing even with a fair amount of distraction going on round him. There is a good deal to be said for this type of reception, when one wishes to hear every word.

Little Jim 2, as with the original receiver, used a B battery for the plate voltage supply, and a filament transformer to light the filament of the 6SN7 twin-triode valve. This version, of Little Jim follows the lead of the set known as Little Jim's Mate, which was the all-battery version of the original.

There are, of course, occasions and circumstances where A.C. is not available, and both filaments and plate supply must be obtained from batteries. It is to cater for these that we present here the little Jim 2 sets remodelled for batteries.

THE CIRCUIT

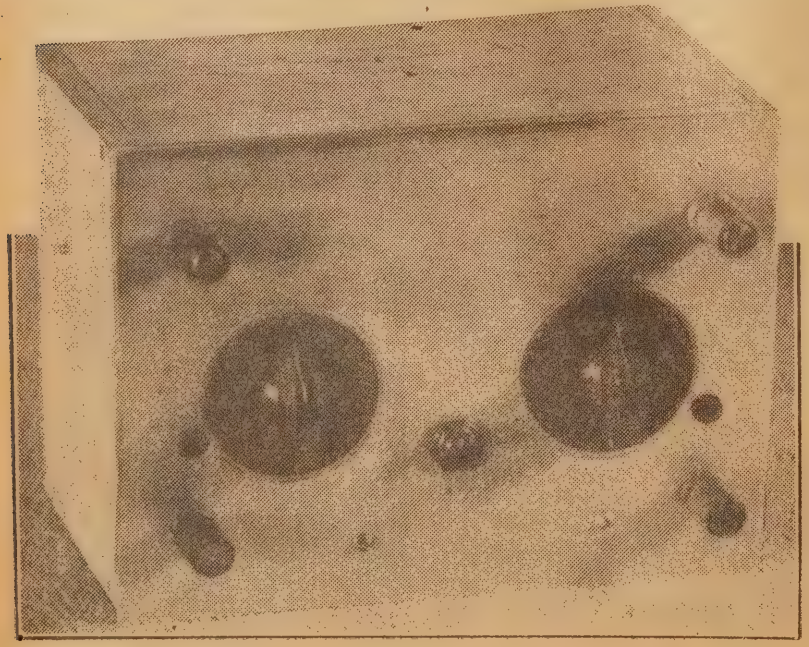
The circuit of the receiver is very much the same as for the A.C. version. a few obvious modifications being required to cater for the directly-heated filament. The valve we have used in place of 6SN7 is the 1J6-G, the standard triode designed for B class operation in battery sets.

The 1J6-G is a 2-volt filament type There is of course, a 1.4 volt dual valve of similar type known as the 1G6G, and this can be used in place of the 1J6-G. It is probable, however, that the 1J6-G will be in somewhat better supply.

The use of the 2 volt valve with a 1.5 volt battery for the filament supply is quite permissible. The 1J6-G has good emission capabilities, and as the high tension drain is only about 1.5 mills, you will find it quite OK.

As there is no certainty that the builder of this set will have our last month's issue on hand, we are giving here a quick description of the circuit in order that this article will be complete.

The set uses one half of the valve, which has two complete triodes in one envelope, as a leaky-grid detector



Front view of the little set. Controls are left — tuning, centre — filament switch, right—reaction. Aerial and earth terminals at left, headphone terminals at right.

with reaction. A standard single gang condenser is used for tuning, and most condensers available will fit into the chassis, and the cabinet without trouble. The reaction is by means of a midget condenser of .0001 mds. maximum capacity.

VARIABLE CONDENSERS

It is not essential that the tuning condenser, or the reaction condenser either, should be of the latest type. There are many old-fashioned condensers available round the radio stores, which can be used quite successfully. Nor is it necessary to adhere strictly to our layout, although as we have taken the trouble to work it out so that the set occupies the least possible space, there is likewise no great point in departing from it without good reason.

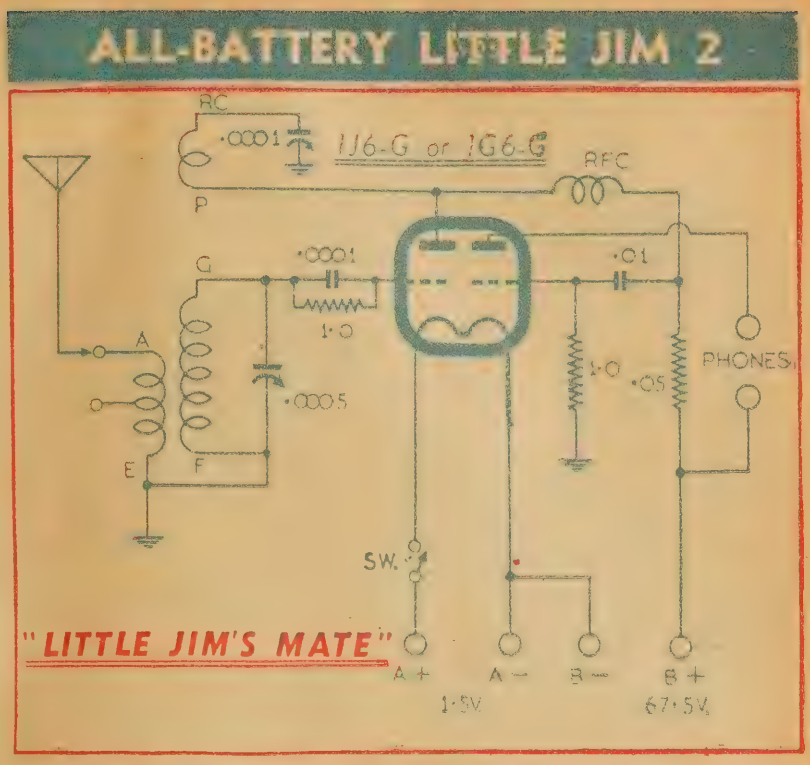
The second half of the 1J6-G is used as a resistance coupled audio amplifier to increase the strength of the signals so that loud reception is possible on headphones.

There is no need to use grid bias on the audio amplifer section of the 1J6-G. This is a zero bias type of valve, and as such operates without bias on voltages up to about 67½v. which is the figure used in this set.

A standard "Reinartz" coil is used in the set, having three windings, aerial, grid, and reaction. The aerial winding has a tap for use with either a short or a long aerial, and you should use the one which gives the best results.

We did not find that bypass condensers were needed either across the phones or from the plate of the detector triode to earth. Should the reaction show signs of instability, however, a .001 mfds. condenser across the phones would be in order, and/or a .0001 mfd. condenser from the B-plus side of the R.F. choke to earth.

As you will see, the circuit is just about the utmost in simplicity, and no one should have the slightest trouble with it.



The circuit is the essence of simplicity.

LAYOUT

The layout of the set is very similar to the Little Jim 2 described last month. It is not exactly the same, because the type 1J6-G valve has a different shaped and sized envelope from the 6SN7, and if placed in the same relative position, would foul the plates of the two condensers.

So, as you will see, we have slightly altered the position of the valve socket. Bear in mind that we have used physically the largest components you are likely to employ, and it is unlikely, therefore, that you will have any trouble with them.

The chassis is actualy a flat plate with a flange to enable it to be bolted to the front panel.

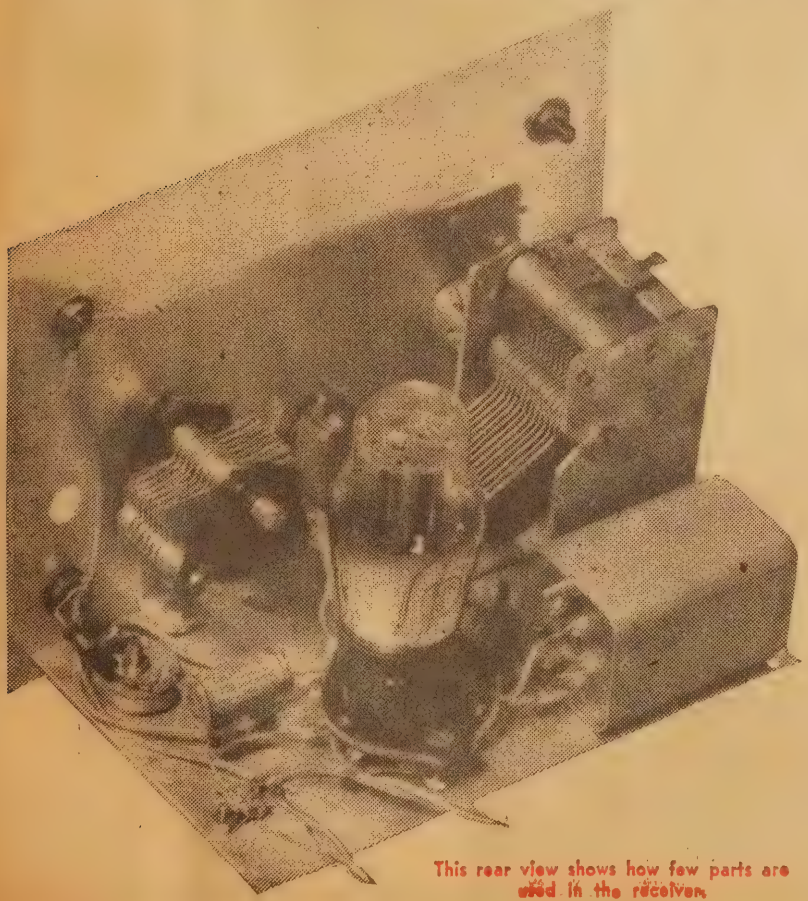
It sits firmly on the base of the cabinet. For this reason, all the bolts holding the parts to this chassis must be the counter sunk type, otherwise the chassis will not sit squarely in the cabinet.

The coil is held in place by bolting the can to the chassis. To do this, the coil is removed from the can, and re-inserted after the latter is placed in position.

The valve socket is supported by two bolts, long enough to prevent the connections from short-circuiting to the chassis.

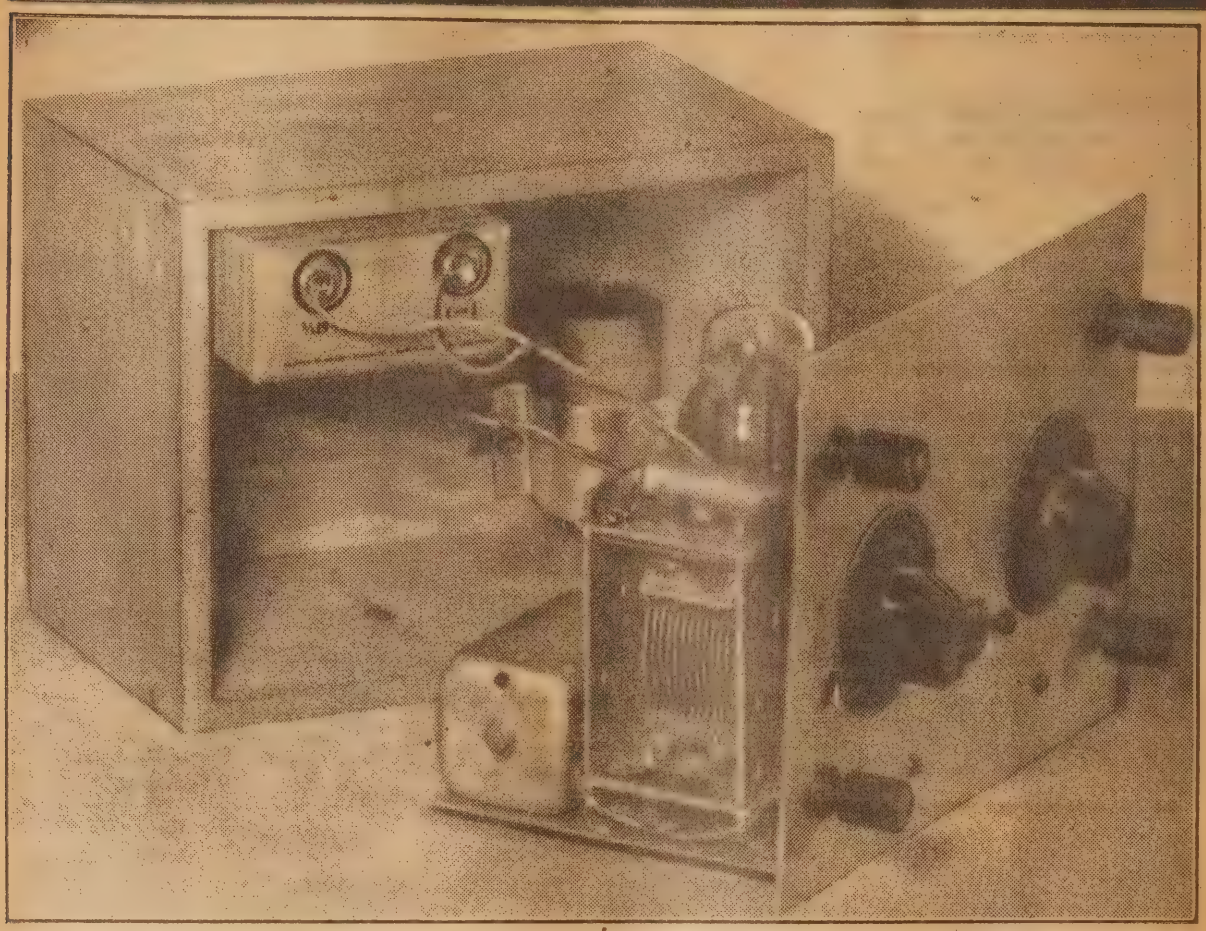
TUNING CONDENSER

The tuning condenser is supported by a pair of brackets, or if it has one-



This rear view shows how few parts are used in the receiver.

SHOWING HOW BATTERIES FIT THE CABINET



Here is the little set standing alongside the cabinet. Note the batteries held in place by small metal brackets.

hole mounting, it can be screwed direct to the panel. The reaction condenser will almost invariably be of the one-hole mounting type, and the battery switch the same.

The wiring up of the set is simplicity itself. As there is no filament transformer to worry about, as with the original version, there is also a little more room to wield your soldering iron, thus making construction particularly easy.

BATTERIES

The set uses a B battery of 67½ volts for the high tension—actually a Minimax type—and a torch cell for lighting the filament.

Both these batteries are held in place by small metal brackets, bolted to the cabinet, to prevent them from moving about. The leads to the set are made long enough for this to be done.

Our diagrams show the position of every wire, and are drawn to scale.

Unfortunately, there is not enough room in the Little Jim cabinet for more than one torch cell to be used. This means that more frequent replacement will be required than with a larger battery. However, the cells are quite cheap, and this is not, therefore, a very important point. If you like to make the cabinet a little bigger than the one suggested, you will no doubt be able to fit in a larger battery.

Incidentally, we found that the measurements given for the Little Jim 2 of last month were a fraction on the small side for use with the Stromberg type of gang condenser. For this reason we have slightly increased the measurements as set out in the specifications of last month, the difference amounting to a mere fraction of an inch. As the Stromberg appears to be the largest of the condensers available, and possibly in shortest supply, either set of measurements will, in most cases, be OK. However, don't be surprised if your factory-made chassis is a little bit larger than our original.

HEADPHONES

The best headphones for use with this set are the standard high resistance type of about 2000 ohms, although we have had quite good results with those selling quite cheaply ex disposals, and having a resistance of about 400 ohms. The higher resistance phones will probably give a bit more volume, although there should be plenty of that on most stations with either type.

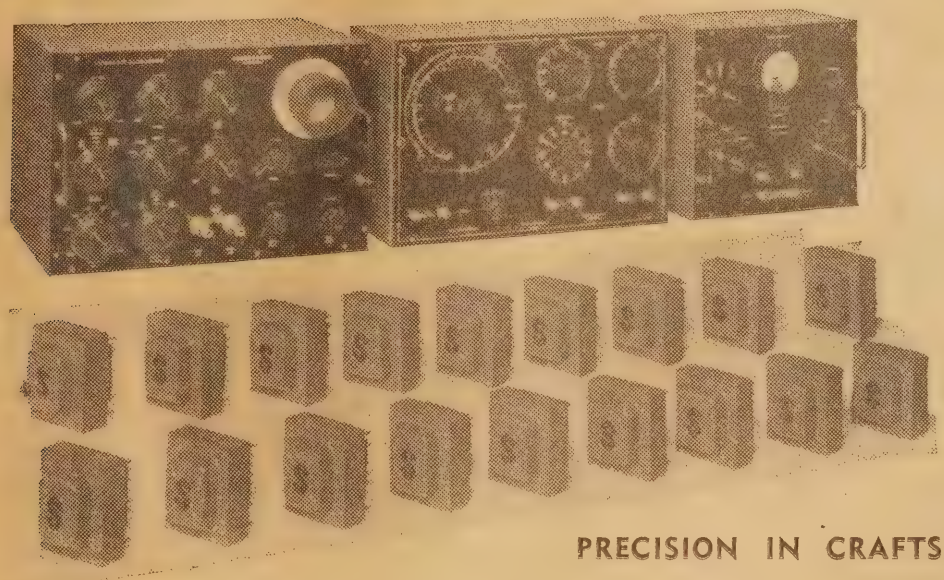
PARTS LIST FOR LITTLE JIM 2 (Battery)

1—chassis 6¾" x 4½" with 1" flange along 6¾" side.
1—panel 7½" x 5¾".
1—single gang condenser app. .0004 mfds.
1—midget condenser .0001 mfds.
1—Reinartz tuning coil.
1—1J6G (or 19).
1—Octal socket (or 6-pin for 19 valve).
1—R.F. choke.
1—50,000 ohm ½ watt resistor.
2—1 meg. ½ watt resistors.
1—.01 mfd. condenser.
1—.0001 mfd. condenser.
4—terminals.
2—pointers and dial scales.
1—Minimax 67½ volt battery.
1—cabinet.
1—pair headphones.
Nuts, bolts, hook-up wire etc.

RED LINE

TRANSFORMERS

PRECISION IN DESIGN



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COMPRISING: CABINET, SINGLE GANG CONDENSERS, SLOW MOTION DIAL, ALL SUNDRIES.

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We Carry An Extensive Range Of All Radio Components.

STROMBERG CARLSON
2 GANG
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CONDENSERS
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MINIATURE 2 GANG CONDENSERS
Will Track H Dial
22/-
Approx 2½ x 1½

PEANUT VALVE SOCKETS
To Suit 1T4 Series
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Extra Special ! !

5-VALVE POCKET
MINIATURE RADIOS
Actual Set Size: 9¼"x3¾"x2"
Using Headphones
BROADCAST OR SHORT WAVE
Battery, A.C. or D.C. operated 110-240 Volts
Incorporating new 1.4 PEANUT VALVES.
This lot INCLUDES BATTERIES, HEADPHONES, POWER PACK. COMPLETE WITH COILS, ETC.
Our price 15 gns.
ALL SETS ARE BRAND NEW
NOTE: This type of set was used in the latter part of the war by ENGLISH COMMANDOES.

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HUGE PURCHASE REPEATED
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4" Dial—1000 ohms per volt
20/6 ea.
EVERY METER IS BRAND NEW

EXTENSION TYPE ROD AERIALS
For Portable Sets.
Beautiful Chrome Finish
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ETHERTONE PICK-UPS
37/6
ALL NEW

RED DIAMOND SEMI-FIXED
CRYSTAL DETECTORS
6/3 ea.

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1 VALVE BATTERY KIT SETS
£6/6/- complete
INCLUDES BATTERY, STC HEADPHONES, LEATHERETTE CABINET ETC, ETC.

8 watt AMPLIFIERS
NEW AND GUARANTEED
£16/16/-
FINISHED IN A CRACKLE METAL CASE WITH CHROME HANDLES

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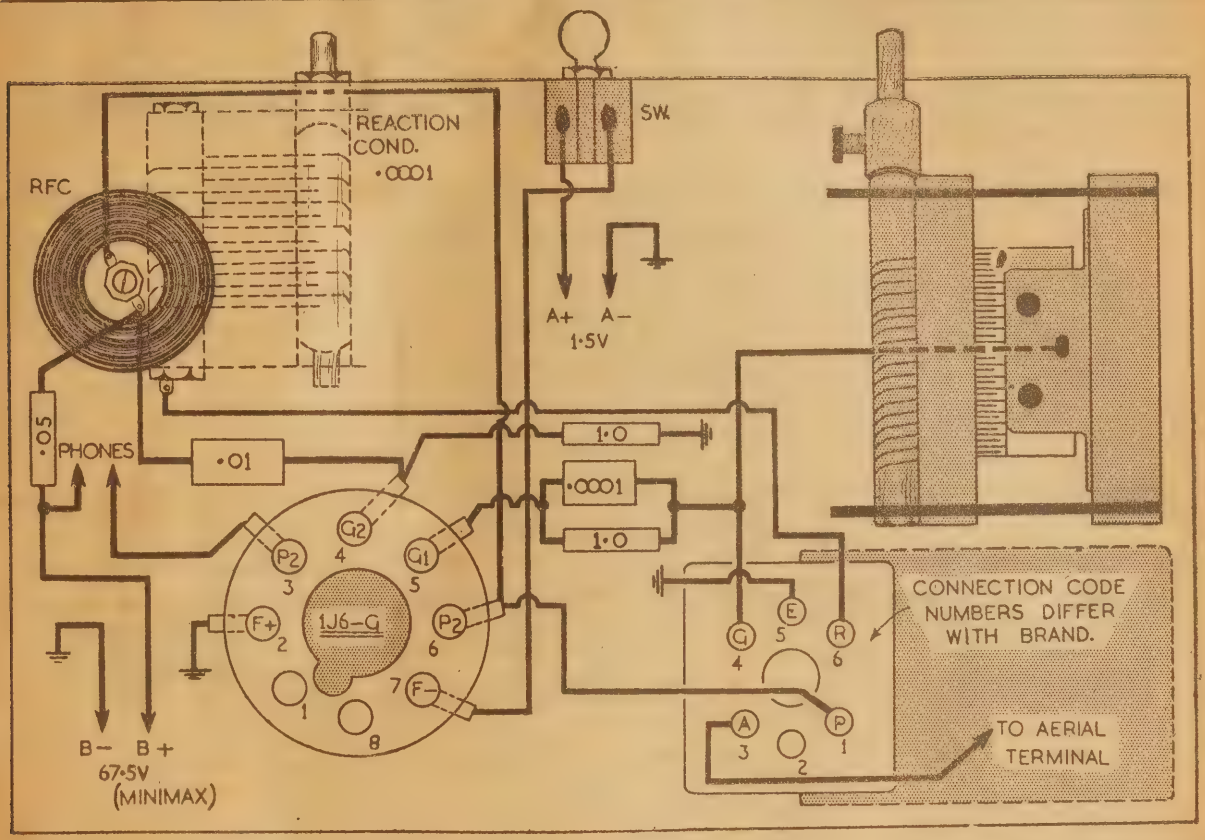
WIRING DIAGRAM FOR BATTERY LITTLE JIM



As with all small sets of this kind. the aerial and earth play a big part in the final results.

The coil is provided with two aerial connections, marked as "long" and "short" aerial connections. The significance of these is of course fairly self-evident and you should try the effect of alternate connection with the aerial you propose to use.

In general terms, a long aerial will give better volume, but will reduce selectivity. However operated here in the heart of the city, overshadowed by 2UW and 2CH, little trouble was experienced in cutting out any one station to receive the remainder. So we suggest that if you are satisfied merely to receive one or two of the stronger stations, you use any convenient aerial which will give enough pick-up.

If you want better results, the first and perhaps best step of all is to provide an effective earth connection. This you will find will improve results in almost any circumstances, and will provide against hand capacity effects in case these are evident.

OUTSIDE AERIAL

Operated in the country, you can probably use a good, outside aerial which with an earth will bring in a surprising number of stations. Again, use the tapping on the coil which gives you the best all round results.

The old idea of the water-pipe earth is quite a good one, and a strap of metal wrapped around a clean section of the pipe will work very nicely. Another good idea is to get a fairly large tin, punch it full of holes, and bury it in the ground, preferably filled with ashes. A length of pipe buried with the tin so that one end projects from the ground will allow you to keep the earth moist by pouring water down the pipe. Don't forget to solder the earth lead to the tin before you bury it!

The foregoing makes a good earth for any set, battery or otherwise.

If you operate the set at your bedside, you will find that a wire spring mattress makes quite a good aerial in the city, with or without an earth.

So you see there is plenty of fruitful experiment you can carry out in regard to aerial and earth, depending on the type of results you want.

Finally, remember that the headphone terminals are connected to the B battery, and therefore care should be taken to see that they are not accidentally short-circuited to the chassis. This will cause a fairly heavy spark, and the drastic drain on the little battery won't help to prolong its life. The voltage is too low to give you a shock of any serious magnitude.

VK STATIONS ACTIVE ON 6 METRES

For the benefit of those interested in the present exceptional conditions on the 6 meter amateur band, the following is a list of stations who have succeeded in making Interstate contacts as at Dec. 10.

VICTORIA. — VK3MJ, 3NW, 3KH, 3GG, 3RW, 3VS.

NEW SOUTH WALES. — VK2WJ, 2NO, 2LZ, 2AZ, 2JU, 2AHF, 2FP, 2AFH, 2ABC.

QUEENSLAND.—VK4AW, 4ZU, 4XG, 4FB.

Other stations active on the band and who no doubt will have made their contacts by the time this appears in print are VK2ZN, 2AFO and 2ABZ.

Although no information is to hand on possible VK5 stations operating it is known that among the VK6 stations are VC6HM, 6FL and 6NO.

We apologise for any errors or omissions in the above list, which has been compiled purely to give as early information as possible to those interstate amateurs who are active on the band. It is to be expected that additional stations will be active in each State in the near future.

As the nature of propagation conditions is such that rapid fading and blackouts are to be expected we suggest that stations keep their "overs" as short as possible. Should overseas stations make their appearance every second of time during which they are audible may be valuable.

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DESIGNING YOUR SHORT WAVE SET

CHOICE of detector has a bearing on the selectivity of the IF channel, in that some detectors load the input circuit, while others have a distinct regenerative effect.

It can be assumed that all but the simplest amateur receivers will have some system of AVC, so that the first choice falls on a diode detector. The diode provides an AVC voltage quite simply, but has the disadvantage that it does load adversely the tuned input circuit. Whether or not this loading effect is important depends on the initial selectivity of the IF channel. If it is poor to begin with, there may be some justification for seeking an alternative form of detector.

CIRCUIT LOADING

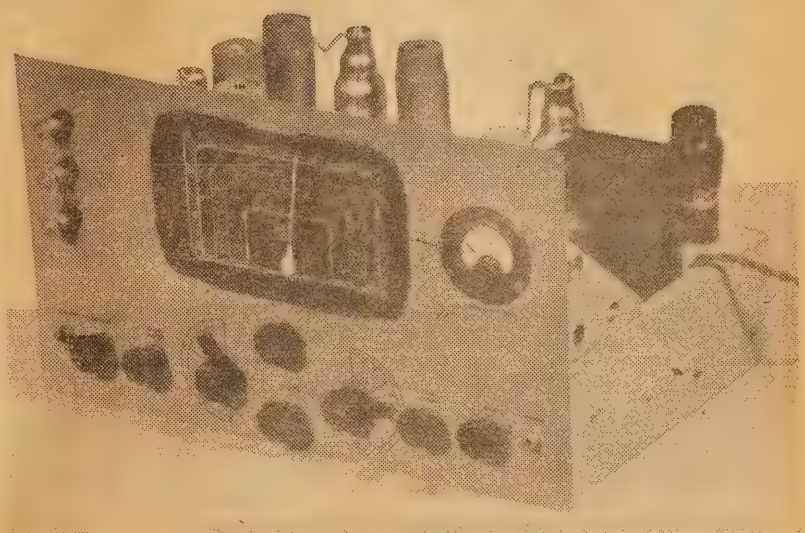
The well-known anode-bend detector does not impose appreciable loading on the oscillated tuned circuit, but suffers the distinct disadvantage that it does not provide a convenient source of AVC voltage.

Thus, when an anode bend detector is used, it becomes essential to provide an auxiliary circuit arrangement to produce an AVC voltage. Such auxiliary circuits either resolve themselves into a separate AVC valve, some form of d-c amplifier, or a special voltage source to operate the anode bend detector at a potential negative rather positive in respect to earth. No one circuit arrangement could be shown clearly to have all the advantages and the choice of detector/AVC system once again resolves itself into a balancing of all factors concerned.

Irrespective of the circuit details, it is essential to provide some means whereby the AVC can be rendered operative or inoperative, according to requirements. This can be accomplished simply by an AVC "off-on" switch, or by a potentiometer which progressively limits the AVC action.

PROGRESSIVE A.V.C.

The latter scheme has much to recommend it, in that it becomes possible to set the control at various intermediate positions, providing just enough AVC to prevent a signal blasting without having the background noise to come up unduly during fading periods or breaks in the carrier.



An experimental short-wave set suitable for amateur use which will probably be described in our next issue. It features band switching of coils, and a new noise silencer circuit which is simple and effective.

As a conclusion to last month's article on short-wave set design, we deal this month with the second detection circuit, AVC, audio channel, etc.

A further advantage is that this form of AVC control can simultaneously supply a manual bias to the controlled valves. Where a simple AVC switch is used, an extra potentiometer is essential, anyway, to limit the gain manually, and to avoid overloading of the IF and detector stages.

R.F. GAIN

It is good practice to apply control voltages fully to the IF amplifier stages, allowing the RF amplifier to operate at all times near maximum gain. However, it is not always possible to operate the RF amplifier completely without control, since it may overload the frequency changer on very strong carriers. For this reason, a small amount of controlling bias on the RF stage is often a good thing.

Application of AVC to the converter valve should be avoided as far as possible in the interests of frequency stability. However, as previously mentioned, some frequency changers are more tolerant of AVC voltage variations than others.

Another point bearing on the AVC voltage is the operation of the signal strength meter or "R" meter, which is often included in more elaborate receivers. The readings of any "R" meter should always be accepted with some reserve, and not treated as an absolute measurement of signal strength. Very obviously, the readings of the meter can be affected by the operating efficiency of the receiver and by the aerial and earth, which factors have no relationship whatever to the true field strength of the incoming signal.

"R" METER

One type of "R" meter takes the form simply of a current meter in the plate circuit of one or both IF amplifier valves. By adjusting the plate current or the sensitivity of the meter, it is possible to make it read exactly full scale, with no incoming signal. In the presence of a signal, the AVC or manual bias cuts down the plate current, causing the meter to read less than full scale. By observing the action of the meter on varying input signals, it is possible to judge fairly accurately, after a while, the comparative strength of the incoming signal in "R" points.

DOUBLE spotting with 455 KC type intermediates is most embarrassing to amateurs on the 20 metre band if the oscillator circuit is tuned higher in frequency than the signal circuit. The double spot in this case will often admit the powerful broadcast stations on the 19 metre band, and even with an RF stage, the signal tuning circuits are not sufficiently selective to reject the image. The cure lies in operating the oscillator lower in frequency than the signal circuit. The double spot, instead of being 910 KC above the 20 metre signals is now 910 KC below them. In this region very few signals are heard strongly enough to cause double spots. With 1600 or 1900 KC intermediate, the double spot will occur 3200 KC or 3800 KC away from the signal. Almost any receiver will be selective enough to reject a double spot so far removed from the wanted signal.

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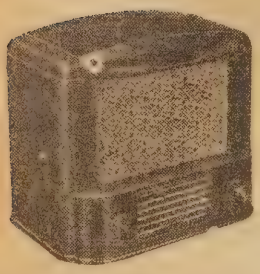

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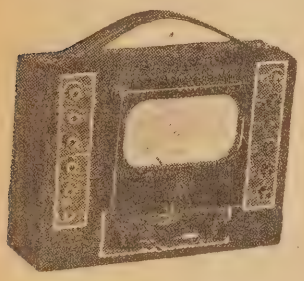

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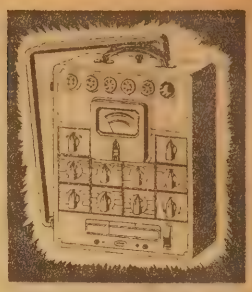

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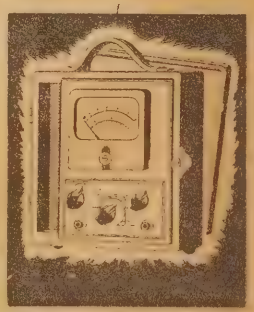

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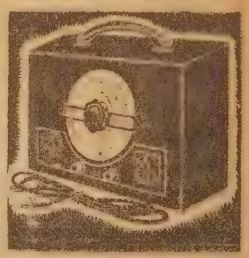

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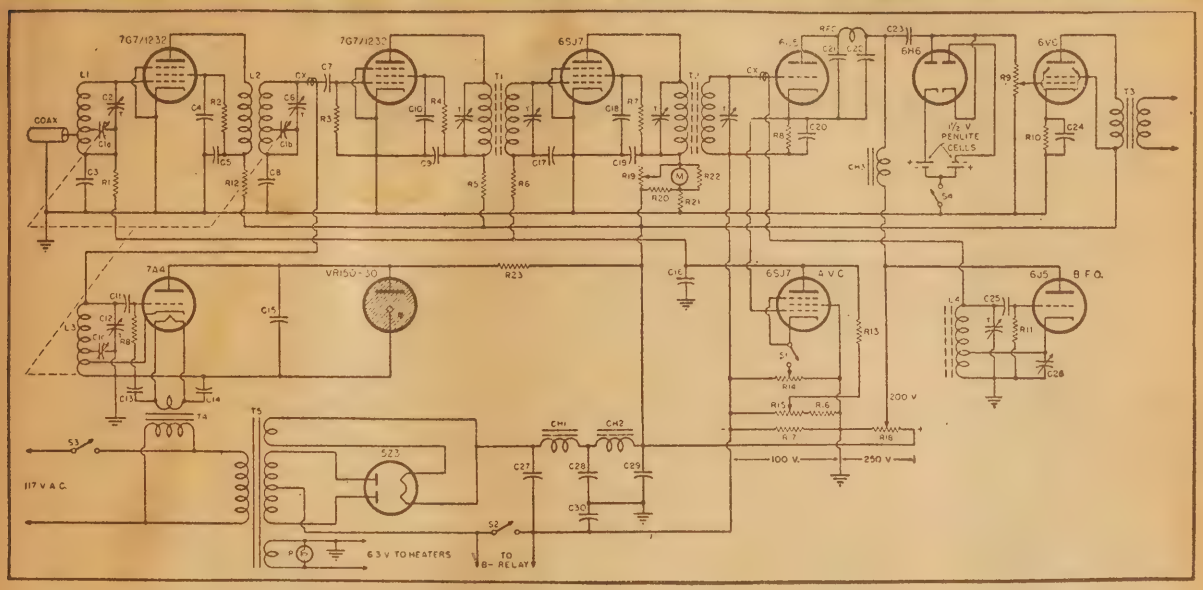

An interesting circuit reprinted from the American "Radio News." This should make an excellent set, and provides an interesting comparison with the one we are shortly to describe.

A much more elaborate circuit arrangement is necessary to make the meter read forward. That is to say, for the meter to read initially zero with no signal input, swinging to maximum deflection with a large input.

Although the result is a desirable one, the means of achieving this forword operation are often quite involved, necessitating, as they do, a special "bucking" circuit, so that the meter reads only the change in plate current caused by the application of an AVC or manual voltage.

AUDIO CIRCUIT

The audio end of an amateur receiver does not need to be anything particularly elaborate, and the usual arrangement is to provide a single voltage amplifier, followed by an ord-

PARTS LIST

R1, R6—1 megohm, ½ w. res.
R2—50,000 ohm, 1 w. res.
R3—5 megohm, ½ w. res.
R4, R7, R21—75,000 ohm, 1 w. res.
R5, R12, R16, R20—2000 ohm, 1 w res.
R8—25,000 ohm, 1w. res.
R9—500,000 ohm pot.
R10—400 ohm, 10 w. res.
R11, R13—100,000 ohm, 1 w. res.
R14—15,000 ohm, 10 w. var.
R15—100,000 ohm pot.
R17—1500 ohm, 10 w. res.
R18—50,000 ohm, 25 w. res.
R19—1000 ohm, wire-wound rheostat
R22—30 ohm, 1 w. res.
R23—3000 ohm, 10 w. res.
Cx—Twisted wire
C1a, C1b, C1c—3-gang, 35 mmfd, per sec. variable cond. (straight line frequency plate shape preferred).
C2, C6, C12—See coil table below.
C3—.1 mfd (or larger), 400 v. cond.
C4, C5, C8, C9, C10, C15, C17, C18, C19—.05 mfd., 600 v. cond.
C7, C11—.001 mfd mica cond.
C13, C14—.01 mfd., 600 v. cond.
C16—.1 mfd. 600 v. cond.
C20—4 mfd. (or larger), 250 v. cond.
C21, C22, C23—.003 mfd. mica cond.
C24—10 mfd., 25 v. elec. cond.
C25—.0005 mfd. mica. cond.
C26—25 mmfd. var. cond.
C27, C28, C29, C30—8 mfd., 450 v. elec. cond.
S1—on R19, S2, S3—on R9, S4—S.p.s.t. sw.
CH1, CH2—10 hy., 100 ma. filter choke
CH3—500 hy., audio choke
T1, T2—Iron core, 1500 kc., i.f. trans.
T3—Output trans., 5000 ohm to v.c.
T4—6.3 v. fil. trans.
T5—Power trans., 750 v. at 100 ma. c.t., 6.3 v. at 3 amps., 5 v, at 2 amps.
L1, L2, L3—See coil table
L4—Iron core, 1500 kc. b.f.o. trans.
RFC—2½mh. r.f. choke
P—6.3 v. pilot light
M—0-1 ma., 3in. square meter
Chassis—17in. x 13in. x 3in. metal chassis

COIL DATA

10 METRES

Osc. (L3)—3 turns, 1¼" long, bandspread tap 1¼ turns from ground. Cathode tap 1 turn from ground. Trimmer (C12) is 50 mmfd.

Mixer (L2)—6 turns, 1½" long, bandspread tap 1⅛ turns from ground. Primary 4 turns closewound. Trimmer (C6) is 15 mmfd.

R.F. (L1)—Same as mixer. Antenna tap 1½ turns from ground.

20 METRES

Osc. (L3)—9 turns, 1¾" long, bandspread 3 turns from ground. Cathode tap 2½ turns from ground. Trimmer (C12) is 75 mmfd.

Mixer (L2)—12 turns, 1½" long, bandspread 3 turns from ground. Primary 6 turns closewound. Trimmer (C6) 15 mmfd.

R.F. (L1)—Same as mixer. Antenna 2½ turns from ground.

40 METRES

Osc. (L3)—18 turns, 1½" long, bandspread 6 turns from ground. Cathode tap 5 turns from ground. Trimmer (C12) is 75 mmfd.

Mixer (L2)—23 turns, 1½in. long, bandspread 8 turns from ground. Primary 12 turns closewound. Trimmer (C6)—is 25 mmfd.

R.F. (L1)—same as mixer. Antenna 6 turns from ground.

80 METRES

Osc. (L3)—20 turns closewound, bandspread, 13 turns from ground. Oscillator cathode tap 7 turns from ground. Trimmer (C12) is 75 mmfd.

Mixer (L2)—40 turns closewound, bandspread tap, 26 turns from ground. Primary 14 turns closewound. Trimmer (C6) is 25 mmfd.

R.F. (L3)—Same as mixer. Antenna tap 10 turns from ground.

RF trimmer, C2, is panel controlled, 35 mmfd. var. cond.

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No matter what your radio needs may be, whether you are an old hand, an up-and-coming "Fan," or a beginner, Collins Radio can, and will, be glad to be of service to you, as to hundreds of others in Australasia. Supplies of the newest gear await your call or letter, and we can usually help out with hard-to-get or special parts.

A special announcement will be made on this page in the next (February) issue—it will be worth reading.

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inary pentode or tetrode output valve. The frequency response need not be studied overmuch, although it should be adequate to permit correct evaluation of the quality from phone transmissions.

Some form of tone control system to modify the frequency response for special requirements is often very helpful, the most important function usually being to limit the treble response, and with it high frequency hiss and noise. A furher contribution to readability under noisy conditions can be effected by limiting also the bass response below 200 or 300 cycles.

NOISE LIMITING

Such tone control effects can be achieved by switching, as in the "1946 Amateur Junior," or by the provision of separate treble and bass controls. However, few constructors will be prepared to tolerate this arrangement, as the front panels of most amateur receivers boast a sufficient array of knobs without this additional complication.

In more elaborate receivers it is fairly standard to include some form of noise limiting circuit, especially if the receiver is to be used in areas where auto ignition interference is a problem. The whole subject of noise limiting is one which cannot possibly be dealt with at any length in an article of this nature, but two or three of the best-known systems can be mentioned.

One system employs an extra diode element interconnected with the normal diode detector. It is so arranged that when the audio output from the detector exceeds a certain peak value, as on a noise pulse, the second diode conducts and short circuits the high amplitude pulse. It is possible to derive the delay voltage for the second diode from the AVC voltage (see circuit in last issue), so that the limiting diode automatically flattens all noise peaks representing an amplitude exceeding 100 per cent. modulation of the incoming carrier.

ALTERNATIVE CIRCUITS

While this automatic operation is simple in use it is not always effective on lightly modulated carriers or on the code signals where the carrier is completely interrupted. Furthermore, if care is not taken, the delay voltage on the limiting diode may be modified seriously by the signal from the beat frequency oscillator.

As an alternative to the above, the delay voltage may be adjusted so that it is proportional to but less than the AVC voltage, or it may yet be supplied manually from the back bias source. Purely manual control of the delay voltage allows the limiting diode to be closed right down on a signal of any strength but, to be completely effective, the AVC action of the receiver must be adequate to hold the signal strength at the detector nearly constant.

The difficulty about noise limiting diodes on the detector circuits is that they usually operate in one direction only, limiting the excessive negative peaks. Peaks in the positive direction are limited, anyway, by the detector diode itself, but they may still exceed considerably the normal positive excursion of the wanted signal.

To be more completely effective it is desirable for a noise limiter circuit to operate in such a way that it limits the signal voltage excursion in both the positive and negative direction. It is as well also to arrange matters so that the limiter operates on a signal intensity of, say, two or more volts, to allow the diodes to operate over a worthwhile portion of their characteristic. If not connected directly to the diode detector the limiter circuit may be applied in the grid or output circuits of the final valve.

ON OUTPUT GRID

One simple arrangement is to couple the two diode elements of a 6H6 (or similar valve) in reverse phase between grid and earth of the output valve. A couple of ordinary 1.5 volt torch cells in the respective cathode and plate returns provides a delay voltage so that the diodes do not conduct until a signal amplitude greater than 1.5 volts is reached.

In operation the audio volume control is advanced until the peaks of the incoming signal just begin to be distorted by the limiting diodes.

Although basically simple, the particular arrangement presupposes that the operator will always find it convenient to turn up the audio volume to the same prescribed figure each time.

The alternative is to derive the delay voltages from suitable positive and negative sources in the circuit, and arrange a potentiometer control in such a way that the diode "gate" can be adjusted to pass only signals within the required amplitude. However, when one begins to work out circuit arrangements which permit this to be done a vast gap is likely to appear between the ultimate circuit and the simple device using a couple of torch cells.

LOW IMPEDANCE

If the effectiveness of the diode limiter is to be retained the addition of controlling potentiometers and other voltage sources should not substantially increase the net impedance of the diode circuit. The diodes should remain completely open circuit for signal amplitudes below the desired level, becoming as near as possible a perfect short circuit immediately permissible amplitude is exceeded. It follows also that the audio circuit across which the shunt is imposed should be of fairly high impedance, for which reason a pentode voltage amplifier is to be preferred to a low impedance triode.

The difficulties of designing a really versatile shunt type noise limiter suggest the alternative method of connecting the diode elements in series with the coupling circuit between the voltage amplifier and output valve. The principle is to have the diodes conducting for signals of normal amplitude, becoming "open circuited" for signals which exceed this amplitude. Our own tests with this type of noise limiter indicated it to be generally more effective than the shunt variety and ex-

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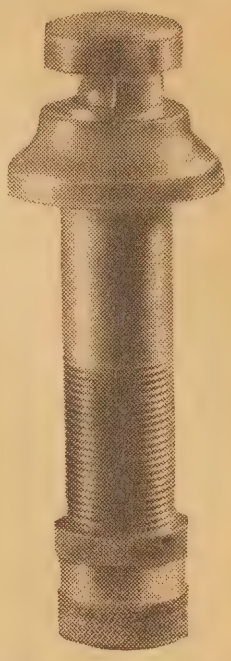

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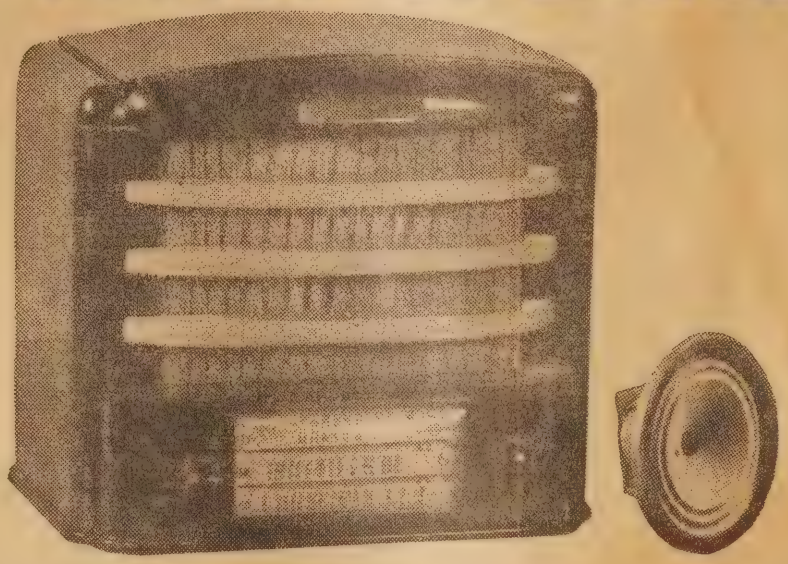

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plain why many of the new overseas commercial receivers are advertising series limiters.

PARTS POSITION

It is interesting to note in passing that new germanium crystal diodes are receiving attention for this purpose, since they promise more abrupt action and lower impedance without the complication of having to provide valve socket and heater supply.

For the actual reproduction of signals amateur receivers should have alternative provision for either loudspeaker or earphones. This can be provided in a variety of ways and the possible circuit arrangements are sufficiently straightforward as not to necessitate lengthy discussion just here.

The power supply, too, is usually fairly conventional, except that rather more than usual attention should be paid to filtering. When listening to signals against a background of interference it is both annoying and unnecessary to tolerate at the same time a background of power supply ripple. This is especially true for earphone reception, the phones often being more affected because of higher sensitivity.

So much, then, for the general subject of amateur receivers. Next month we plan to describe in detail the circuit of a nine-valve receiver utilising many of the principles referred to generally in this article.

We plan to give the complete circuit diagram and sufficient data and explanatory matter and data to allow an experienced constructor to go ahead and build one very similar to the original. We use the words "very similar" quite deliberately because, in a set of this nature, constructors normally like to press into service items of equipment which are already on hand.

This is especially true just now, when most amateurs have been busily acquiring useful oddments from Army and Navy disposals. Useful gang condensers, I.F. transformers, B.F.O. coils and sundry other items have been selling in transceivers for a fraction of their original cost. You will probably recognise some of these in our own receiver.

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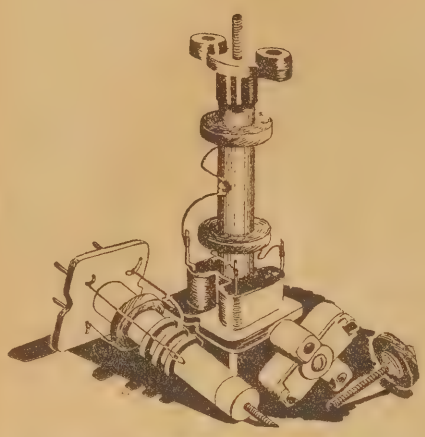

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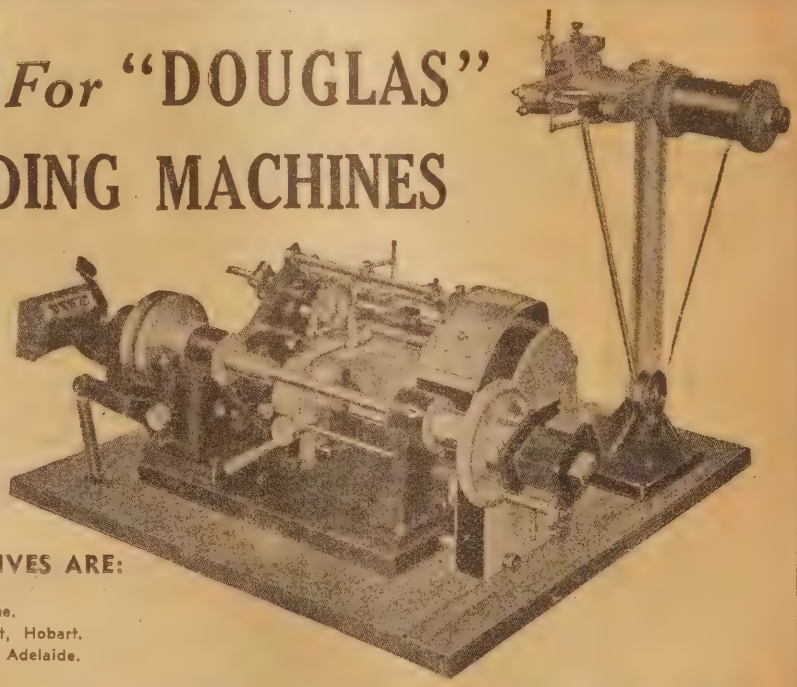

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A COURSE IN RADIO TRANSMITTERS

Written especially for "Radio and Hobbies" by the Technical Staff of The Australian Radio College.

Continuing on from last month's discussion, this article goes into the subject of impedance matching as applied to modulation.

Any source of power is considered as a generator, and when the current or voltage is alternating or fluctuating, as in audio frequency applications, we indicate the generator by the symbol shown by Figure 2. Every generator has a certain amount of internal resistance. Current flowing inside the generator has to pass through this resistance.

In the case of an ordinary carbon microphone there is resistance in the carbon granules, while with other types there may be reactance as well as resistance, in which case the generator will have impedance. There is resistance in a radio valve, which we term "plate resistance." Also we have resistance and reactance in both windings of a transformer.

INTERNAL IMPEDANCE

The internal resistance or impedance of a generator may be represented as at the left-hand side of Figure 3 where E indicates the voltage and r indicates the internal resistance. All generators must work into some form of load. The load with which we are mainly concerned when modulating an amateur transmitter is the impedance presented by the modulated amplifier. The nature of the load will be governed largely by the form of modulation which is used. In some cases the load may be resistive while in others it may consist of resistance and inductance combined. For the purpose of schematic representation, it is convenient to indicate the load as an equivalent value of resistance as at the right-hand side of Figure 3, the symbol then being R.

The part which furnishes power is generally called "the source," and, as just indicated, the part which uses up the power or into which the power is passed is termed "the load." Any source will deliver the greatest possible amount of power to any load when the resistance or impedance of the load is equal to the resistance or impedance of the source. We are of course speaking of the internal resistance of the source.

LOAD IMPEDANCE

As the load impedance varies above and below the source internal resistance or impedance, the power transferred varies somewhat as shown by the curve in Figure 4. As the load resistance is made greater than that of the source we suffer comparatively little reduction in power transferred, but as the load resistance is made less than that of the source we find a very serious loss of power almost immediately.

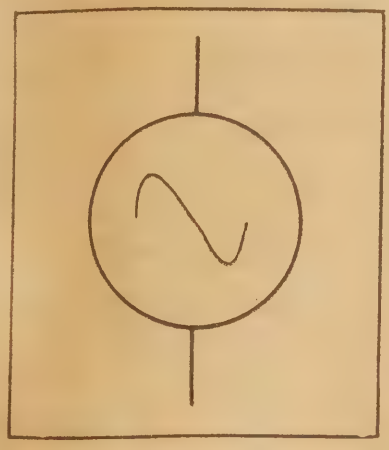

FIG. 2.

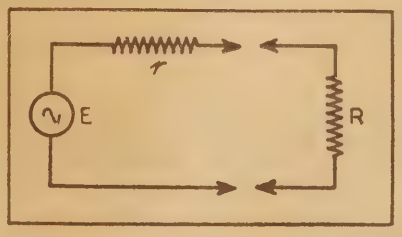

FIG. 3.

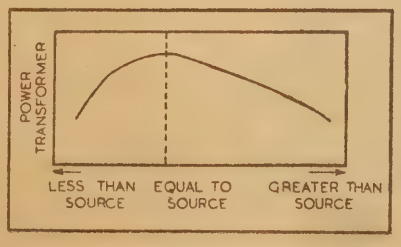

FIG. 4.

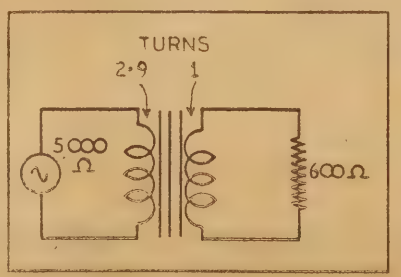

FIG. 5.

There are applications where it is not necessary, or even desirable, that the impedance of the load should be equal to the impedance of the source. However, that is something with which we will deal in a moment.

It often transpires that under given working conditions, there is little we can do to alter the impedance of the source, although it is sometimes possible to alter the load impedance, so that it actually is in correct relation to the source. But in many cases, we cannot even alter the load to obtain the necessary impedance match. Then we resort to an impedance matching transformer, or to a network of resistance which allows correct matching.

MATCHING TRANSFORMER

An impedance matching transformer is connected between the source and the load as in Figure 5. The purpose of the transformer is to make the impedance of the load appear to the source as having the correct figure for the optimum transfer of energy.

We may designate the transformer's primary impedance as Zp, and its secondary impedance as Zs. To obtain a correct match we do not need to have Zp equal to the actual resistance, or impedance of the source, nor do we need to have Zs equal to R, in Figure 5. In other words, the unloaded transformer primary impedance need not equal the source impedance, and the transformer secondary impedance need not equal the load impedance in ohms. We are not attempting to match the source and load impedances with the transformer primary and secondary impedances, but we are attempting to make the ratio of transformer primary and secondary windings suit the ratio of load and source impedances. In fact, the impedance of the transformer winding alone should be higher than that of the source or load even at the lowest frequency to be handled.

TURNS RATIO

In working out the impedance of a transformer winding, we deal with the square of the number of turns in the winding. In fact, the impedance of the windings is directly proportional to the square of the number of turns. The correct turns ratio for matching terminal impedances is found from the formula.

Turns Ratio equals square root of Impedance Ratio

Turns Ratio equals Impedance Ratio squared.

This formula says to take the square root of the number, which in the firs

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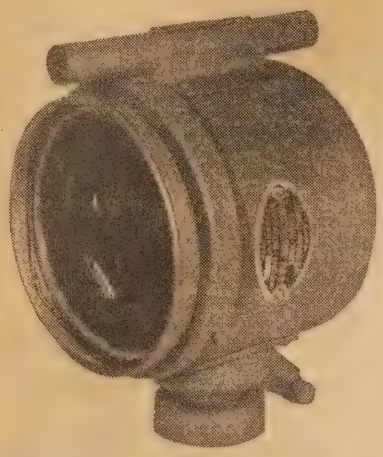

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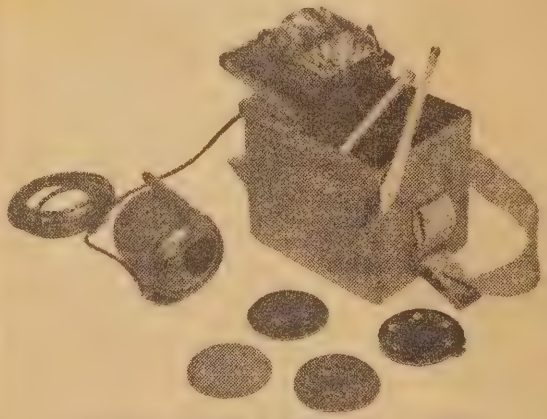

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place is found by dividing the source impedance by the load impedance in ohms, or vice versa if the load impedance is greater than the source impedance. In Figure 6 we wish to connect a source with 5000 ohms impedance into a load having 600 ohms impedance. What should be the turns ratio of the coupling transformer?

Dividing the source impedance (5000) by the load impedance (600) gives us 8.33. The square root of 8.33 is 2.886, or approximately 2.9. The transformer should therefore have a turns ratio of 2.9:1. That is, for every one turn on the secondary winding there should be 2.9 turns on the primary winding. We would call this a "step-down" transformer.

We now have the turns ratio required in the matching transformer, but we have said nothing about the actual impedances of the two windings. The actual impedance has little to do with the matching problem, since it is the turns ratio which secures the match. But the impedance of the windings, especially of the primary winding, is quite important, because it determines the efficiency of the transformer over the required frequency range.

IMPEDANCE OF WINDING

The greater the impedance of the primary winding, which is connected to the source, the greater will be the amount of power transferred to the secondary and the less will be the amount of power dissipated to no purpose in the primary winding. On the other hand we might have so much primary impedance that it would act like an open circuit of infinite impedance, but in practical designs the matter of cost and of size prevents any such thing from happening.

Supposing we have the condition of Figure 7, where the source is a pure resistance. The resistance of this source will show no change as the frequency is raised and lowered. But it is connected to a transformer primary winding in which the impedance is made up very largely of inductive reactance, and this reactance changes in direct proportion to changes of frequency.

With such a state of affairs the operation of the circuit will be satisfactory only while the real impedance of the transformer primary is equal to or greater than the impedance of the source. We must build the primary with enough inductance to ensure that its impedance, at the lowest operating frequency, will not be below the resistance or impedance of the source in ohms. If we wish to work down as low as 100 cycles, then the primary must have an impedance at 100 cycles, which is at least equal to the source impedance.

At all higher frequencies the primary impedance will naturally increase and operation will improve, while at all lower frequencies the primary impedance will drop below that of the source and there will be a rapid falling-off in power transfer. To sum up, then, we obtain power transfer by matching impedances with correct turns ratio and we obtain efficient operation by using windings of high impedance.

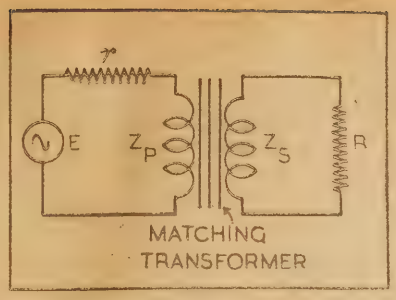

FIG. 6.

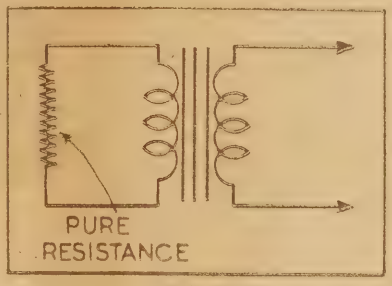

FIG. 7.

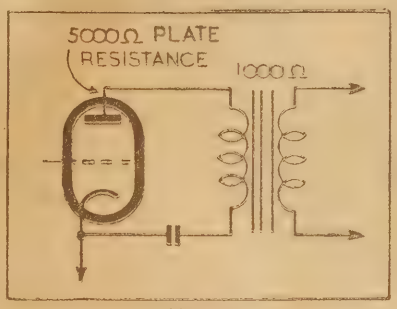

FIG. 8

We have so far been working upon the assumption that we desire the greatest possible transfer of power, which is what we obtain when the impedance of the source and of the load appear equal to each other. But when we come to handle the output of amplifying valves, we must have maximum undistorted power, and to secure such a result the actual impedance of the load must appear, in the case of triode valves, to be at least twice as great as the valve's plate resistance.

In Figure 8 we have a triode valve the plate resistance of which is 5000 ohms. Under such conditions the impedance presented by the coupling transformer primary must be at least 10,000 ohms for the lowest frequency at which we expect satisfactory output without distortion.

If we are handling push-pull valves as in figure 9, the plate resistances are in series and so add together. Then the total impedance of both halves of the coupling transformer primary must be at least double the total plate resistance of the two valves together. Or, we may say that each half of the output transformer primary must have an impedance at least double the plate resistance of either valve alone.

SECONDARY WINDING

We have found that it is necessary to build the primary of the transformer with enough actual impedance in ohms so that it is at least equal to or preferably double the impedance of the source, when triode valves are being used. This determines the value of the primary impedance. Then we also found that a certain turns ratio is required for a proper impedance match. The number of turns in the primary depends on the real impedance we need and the number of turns in the secondary depends on the turns ratio. Therefore, the number of secondary turns and the real impedance of the secondary is indirectly determined by the primary turns and the turns ratio. There is no need to calculate the required secondary impedance separately.

While it is true that with triode valves the load for maximum undistorted power output should have an impedance equal to about twice the plate resistance, the same conditions do not apply when pentode or tetrode valves are used. The determination of the correct load for a pentode or tetrode valve is a far more complex business than simply multiplying the plate resistance by two or more. When these valves are used we rely upon the manufacturers to give us a recommended load impedance, which is much lower than the plate resistance of the valve.

MATCHING TRANSFORMERS

The recommended load should always be used if optimum results are to be achieved. Even with triodes the load conforms to the previously mentioned rule only when the valve or valves are intended to operate in Class A. The required load impedance for Class B or AB operation may not be equal to twice the load impedance.

When operating conditions are fixed to begin with, and when the appropriate apparatus is especially designed and built for these conditions, we match impedances with transformers having only two primary terminals and two secondary terminals. Where conditions may be varied from time to time, or where they cannot be accurately determined to begin with, we often resort to the use of special transformers having several taps brought out from the secondary winding and possibly several taps from the primary winding. Such a transformer is indicated in figure 10.

A properly designed tapped transformer allows the choice of a very great range of turns ratio and it is

(Continued on Page 76)

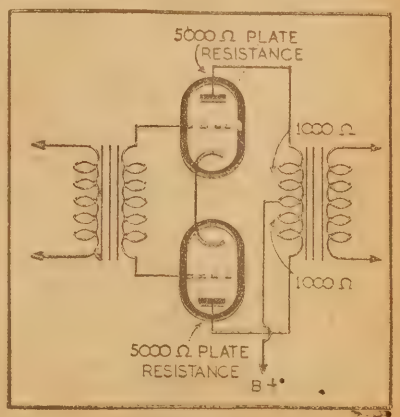

FIG. 9

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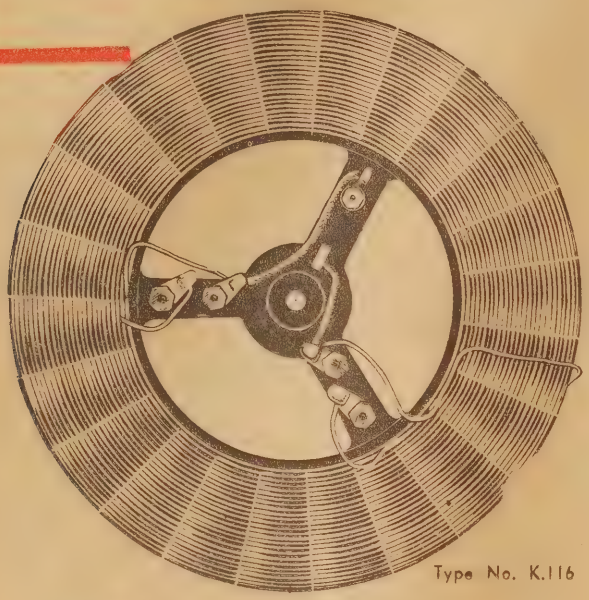

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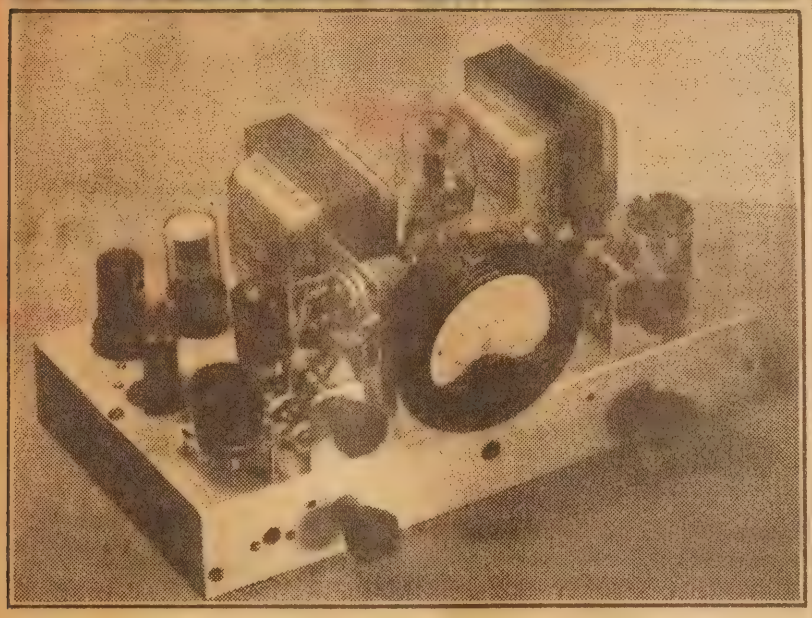

The transmitter referred to below. The modulator section is at the rear. Note plug-in coils.

In our next issue we will describe the construction of a new, low-powered transmitter we have just completed. It is ideal for the new "ham" or as a standby for multi-band operation.

WHEN he first receives his licence, the new amateur is, of course, faced with the problem of what transmitter he shall build. He does not require anything very complicated, but he does require a design which, at a later date will, enable him to expand without wastage of parts. As a rule his ambitions concerning power are satisfied by about 25 or 30 watts, which he would like to obtain with a modest outlay.

The man who has held a licence for some time frequently finds himself faced with a rebuilding problem and no equipment on hand to tide him over this rebuilding period. Many such hams have sighed for a small, but versatile transmitter as a stand-by capable of phone operation on the main amateur bands.

A NEW TRANSMITTER

With this in mind we have recently built up a transmitter which appears to satisfy all these requirements. Essentially it comprises a 6V6G Tritet oscillator, driving a 807 as a final amplifier. It is capable of operation on three bands from a single crystal. On the fundamental frequency the 6V6G may be operated as a straight oscillator driving the amplifier, also tuned to the fundamental frequency, say 7 mc. For 14 mc. operation, the Tritet is used as a doubler. For 28 mc. operation the 6V6 operates as a quadrupler, again driving the 807 as an amplifier.

The 6V6 is able to drive the 807 adequately on all three bands, giving approximately 15 watts input with a high tension supply of 300 volts and correspondingly higher input if used with high voltage.

On the same chassis is included a modulator which uses a 6A6 or 6N7 as a "B" class amplifier. The driver is one section of a 6SN7, the second section being used as an audio amplifier. In order to provide sufficient gain for operation with a hand dynamic microphone, a pre-amplifier is provided for, which may be either a triode or a pentode.

SUPPLY VOLTAGES

With a plate voltage of slightly over 300 volts, the modulator gives a measured output of approximately 12 watts without appreciable distortion, thus allowing good results on phone with inputs of approximately 25 watts.

The photograph shown above illustrates the layout of the transmitter. The chassis measures only 13in. x 7in. x 2in., plug-in coils wound on valve bases being used for all but the oscillator cathode coil.

In operation the transmitter has given first-class results to date on the 14 and 28 mc. bands. It was originally intended for use as a stand-by at VK2JU, but it has so tickled the imagination of those who have heard it that we are acting on the suggestion that a description should appear in "Radio & Hobbies."

The power supply for the transmitter is contained on a second chassis of the same size. There is sufficient room on this chassis to built a receiver capable of covering all bands down to 28 mc. This receiver is now in the course of construction, and if it turns out as we expect, will make an excellent companion for the transmitter.

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FOR DUAL-WAVE OPERATION

The Vibra-Five

five valve vibrator set

Following on last month's article, it seems the logical thing to describe a dual-wave version of the Vibra-Five receiver. The result is a set which will find a proud place in any country home. Covering both bands without any fuss or interference, the receiver operates entirely from a single 6-volt accumulator.

IN planning the dual-wave version, we were careful to adhere to the circuit and layout of the original broadcast set. In fact, we left most things exactly as they were and simply added the necessary extra components. A few hours work and the dual-wave version was a reality.

Readers can follow exactly the same plan. Build the broadcast receiver, if you want it that way, but keep this issue handy. At any date in the future it is simply a matter of buying a few extra parts, wiring them in and you have a dual-wave set with a minimum of trouble.

In the light of last month's article, there is no need to examine the electrical circuit in any detail. Just a few general remarks for those who may not have seen the earlier issue.

Reviewing the circuit briefly, a 1M5-G is used as R.F. amplifier, operating with zero initial bias and a screen voltage of about 60 volts.

THE CONVERTER

This feeds into a 1C7-G converter valve, operating under fairly standard conditions. The screen voltage is also 60, but an initial grid bias of minus 2 volts is provided by the position of the filament in the series filament network.

The I.F. amplifier is another 1M5-G, operating under the same electrical conditions as the R.F. amplifier. All three valves are subject to A.V.C. voltage on the broadcast band, but the direct earth return of the short-wave R.F. coil isolates the A.V.C. from the converter grid on the short-waves, in the interest of frequency stability.

A 1K7-G provides diode detection and A.V.C. voltage, with the pentode portion acting as a high gain resistance-coupled audio amplifier. This feeds the grid of 1L5-G output valve, operating with 140 odd volts on plate and screen, and a total grid bias of minus 6 volts. Four volts of the bias is accounted for by the filament connection, and two volts from the back bias source.

With 140 to 150 volts on plate and screen, and negative feedback to improve matters, the 1L5-G delivers enough audio power to sound very impressive on a modern permagnetic loudspeaker. At ordinary volume there is nothing to suggest that one is not listening to a much more powerful a-c receiver.

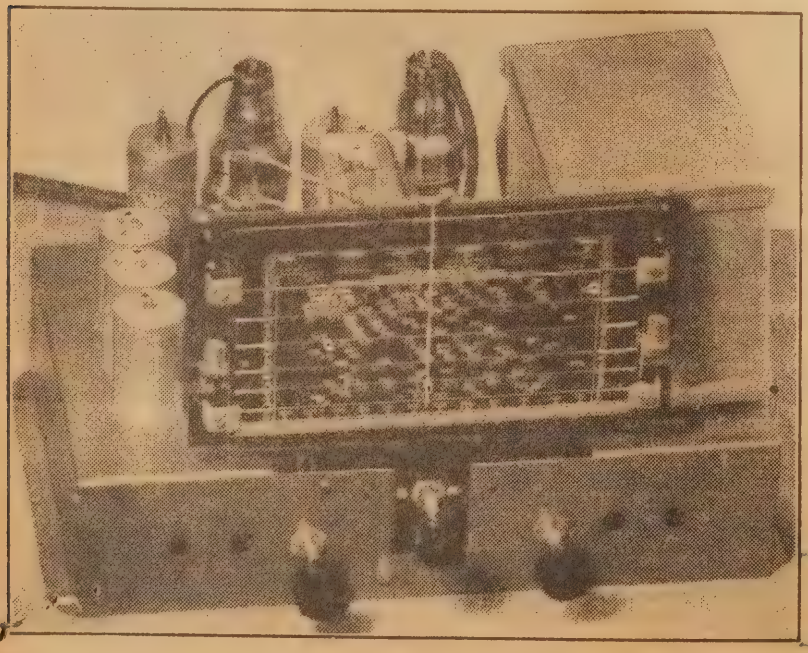
WIRING AND LAYOUT

In the wiring and layout of the set there is little basic difference from the broadcast version discussed last month. Space has to be found for the short-wave coils and trimmers, and the panel controls rearranged to suit.

The volume control is now mounted to the right of the tuning knob, and the corresponding position to the left is occupied by the wave-change switch. This switch is also used to turn the receiver off and on, so that a separate "off-on" switch is no longer required.

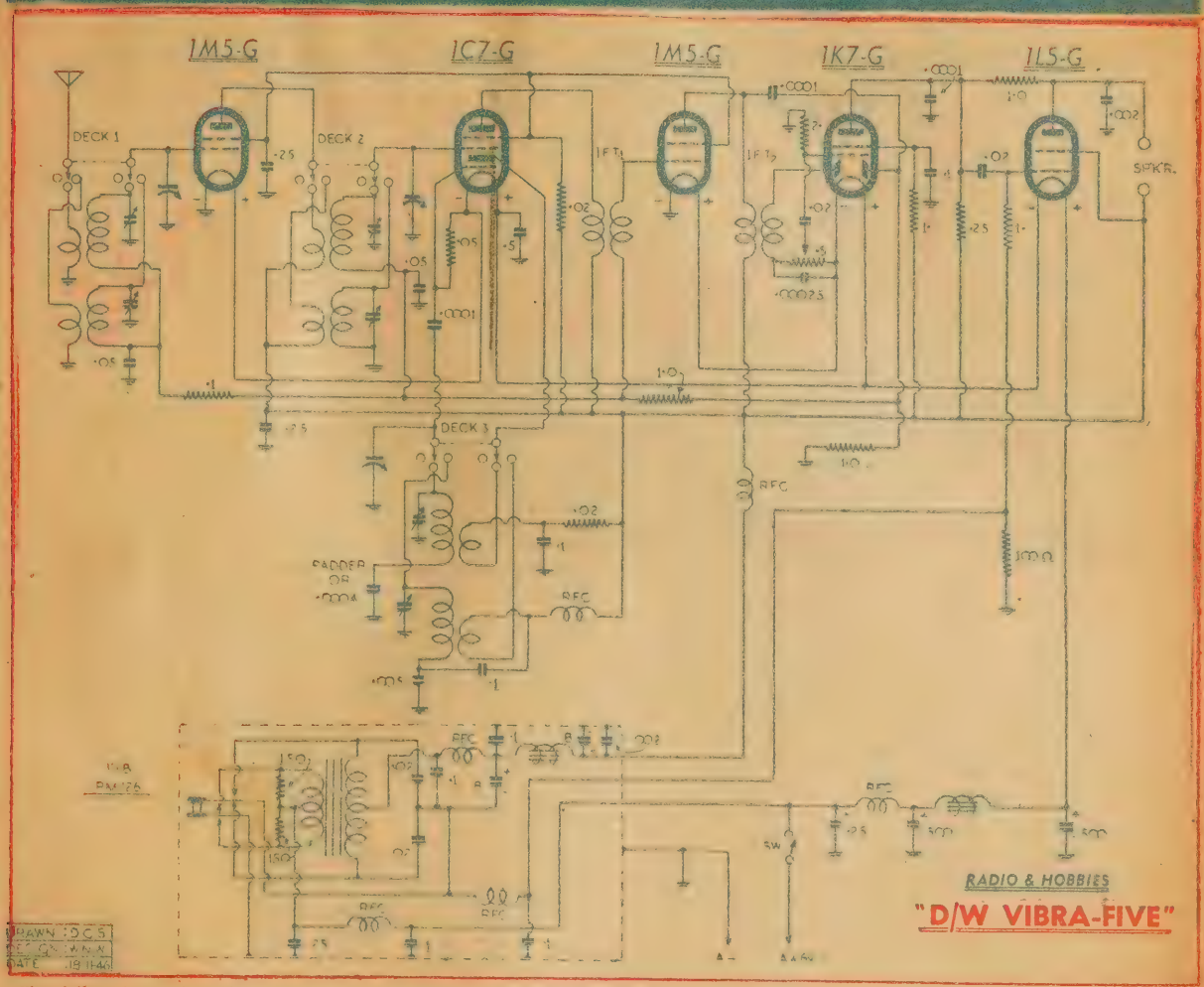
In placing these two controls, there is an option of three positions in the "1946 Standard" chassis, on which the set is built. The two innermost mounting holes were utilised for this version to obtain the shortest leads and easiest wiring.

Possibly the most pleasing panel balance would result from using the centre holes for the controls, but a deal of juggling would be necessary to avoid shorts between the socket



The set looks much like the broadcast version, but the knobs are placed differently.

ORIGINAL CIRCUIT MODIFIED FOR DUAL-WAVES



The full coil switching has been shown in the circuit diagram.

pins and switch banks, and later to instal the connecting wires. An alternative, for those who like elaboration, would be to use the inner positions as suggested, but to instal two extra outside control knobs, one for a separate "off-on" switch and the other as a treble tone control. We preferred to keep the set simple and avoid these rather unnecessary complications.

As previously mentioned, the receiver was constructed on the chassis originally designed for the "1946 Standard" a-c receiver. The components mount in orderly sequence from R.F. stage to output valve, and details are made amply clear by the photographs and diagrams. These also give a reasonable idea of the positions for the minor components and wiring, although various concessions had to be made in the wiring diagram for the sake of clarity.

COMPONENT MOUNTING

When building the receiver, mount all major components in the usual way, taking care to see that coils, I.F. transformers and valve sockets are so placed that the leads can be connected conveniently. Put solder lugs under nuts here and there around the chassis

PARTS LIST

VIBRATOR

1 Metal Box, 6 x 4½ x 4¾in. (See text.)
1 Base plate, 5½ x 3¾in. (See text.)
1 Vibrator transformer, 6 volt Pri-. 135 volt Sec.
1 Synchronous Split-reed vibrator cartridge.
1 Valve socket to suit vibrator cartridge.
1 High tension iron-cored filter choke.
2 High tension R.F. chokes.
1 Low tension R.F. choke.
2 8 mfd. electrolytic condensers, 525 P.V.
1 .25 mfd. Tubular condenser.
4 .1 mfd. tubular condensers.
2 .02 mfd. mica or tubular condensers. Not less than 600 volt working.
1 .002 mfd. mica condenser.
2 150 ohm resistors. 1W.

SUNDRIES

Hook-up wire, solder lugs, nuts and bolts, 4 long bolts, for mounting vibrator unit, 8 small rubber grommets, 1 large rubber grommet.

RECEIVER

1 Chassis 14 x 9 x 3in. (1946 Standard)
1 3 gang tuning condenser ("H" or "AWA" type)
1 Tuning dial to suit.
3 Broadcast coils. (Aer. R.F. Osc.)
3 Short-wave coils (Aer. R.F. Osc.)
2 Iron-cored I.F. transformers.
1 3-bank 3 x 3 Rotary switch.
1 Low tension iron-cored filter choke.
2 Low tension R.F. chokes.

RESISTORS

1 2 meg., 5 1 meg., 1 .25 meg., 1 .1 meg., 1 .05 meg., 2 .02 meg., 1 150 ohm, 1 .5 meg. potentiometer.

CONDENSERS

2 500 mfd. 12 P.V. electrolytics, 1 .5 mfd. tub., 3 .25 mfd. tub., 3 .1 mfd. tub., 2 .05 mfd. tub., 2 .02 mfd. tub. 1 .0002 mfd. mica, 1 .00025 mfd. mica, 1 .0004 mfd. mica or padding condenser, 6 trimmers. 1 .005 mica.

VALVES

2 1M5G, 1 1C7G, 1 1K7G, 1 1L5G.

SPEAKER

8in. or 10in. permagnetic type matched to output valve 1L5G (15,000 ohms)

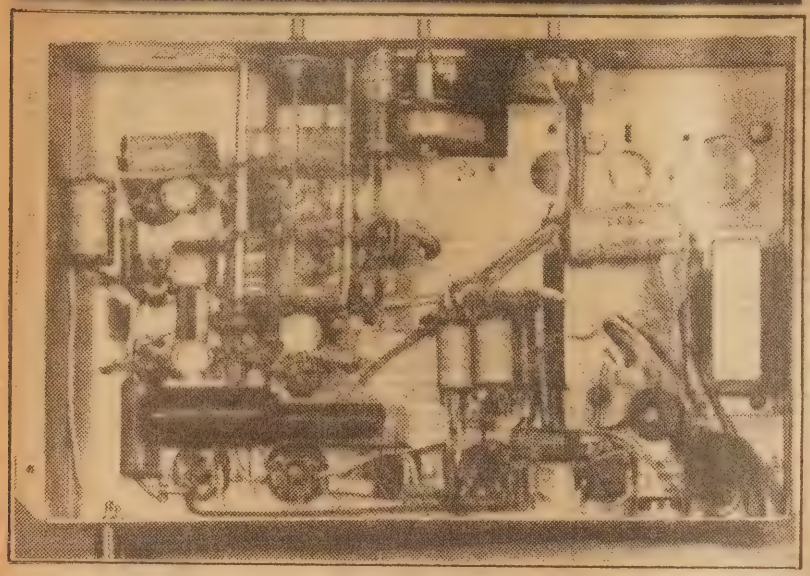
BATTERY

1 6 volt accumulator of not less than 100 amps capacity.

SUNDRIES

5 Octal sockets, 1 4-pin socket, 1 4-pin plug, 2 terminals, 3 knobs, dial lamps, 4 valve shields, 4 small grid clips, nuts and bolts, 2 battery clips, hook-up wire, shielded wire, 3ft. of heavy two-way cable for battery lead.

UNDER CHASSIS VIEW OF SET



Compare this under-chassis picture with the actual wiring diagram.

for earthing of resistors and condensers.

Mounting of the wave-change switch calls for considerable care if the individual switch wafers are to be conveniently placed in relation to the sockets.

Make sure to buy a switch with a central bar at least 5in. long and obtain sufficient spacing bushes and assembly rod to allow the final switch bank to be located a little less than 5in. from the front edge of the chassis. This will bring the ossillator switch bank just to the front of the 1C7-G socket.

SWITCH BANK

The R.F. switch bank should fall just behind the 1M5-G socket, with the aerial switch bank in front of that again. This arrangement makes for simplicity of layout and wiring.

Assemble the switch so that it conforms to these requirements, trimming the spacing pushers and rods as necessary. Check your work by holding the switch in place, but it should not be mounted permanently into position until the rest of the wiring has been completed.

At this stage also you will have to decide on suitable positions for the short-wave coils and drill holes to suit. The type used in the original required single 5-32in. Whitworth mounting screws.

The short-wave aerial coil is mounted horizontally just to one side of the switch and close to the first bank; the R.F. coil is alongside the second bank vertically, and the oscillator coil just behind the switch. There is no need to mount these coils finally in position until the rest of the wiring has been completed.

EARTH NETWORK

Begin the wiring by running a length of tinned busbar between the various solder lugs so as to make a continuous and handy earth network. Next put in the filament wiring, being most careful to follow out exactly the schematic and wiring diagrams. After that the various other leads can be added, as shown in the underneath wiring diagram, and finally as many of the smaller components as possible.

The wave-change switch recommended is the "3 x 3" variety, which means that there are three sets of contacts on each bank and three switch positions. Only two sets of contacts are needed on the aerial and R.F. banks, but the third set of contacts on the oscillator bank is used to make and break the circuit to the 6-volt accumulator.

The switch must be so wired that, in the anti-clockwise position, the battery circuit is open and the receiver therefore rendered inoperative. In the centre position the battery circuit is closed and the aerial, grids and plates switched through to the broadcast coils. In the third position (clockwise), the battery circuit remains closed but the short-wave coils are brought into use.

OUR DIAGRAMS

Readers who are familiar with dual-wave sets will probably not experience much difficulty in working directly from the main schematic circuit, which shows all connections to the switch and coils.

However, as a guide to less experienced constructors we have drawn the switch banks separately as they appear when viewed from the rear of the chassis. Contacts used have been numbered to correspond with the various points in the wiring diagram, to which they connect.

Select one set of contacts on the front switch wafer and identify the lug which makes permanent connection with the sliding contact shoe. If this is made to correspond to connection "1" in the diagram, it will thus have to be wired to the aerial terminal of the set. The lug immediately alongside it will normally make contact with the sliding shoe with the switch in the extreme clockwise position. This has been numbered 3 and connects to the "A" terminal on the short-wave aerial coil.

The next lug, number 2, connects to the "A" terminal on the broadcast aerial coil. No connect whatever is made to the third lug in this set of contacts.

A second set of contacts numbered 4, 5 and 6, connect respectively to the aerial tuning gang, short-wave "G" terminal and broadcast "G" terminal on the respective aerial coils.

The same code system is used to identify the connections to the R.F. and oscillator switch bank. In the latter case all three sets of contacts are used, the third set being utilised to break the battery circuit. Lug 19 is connected directly to the lead from the accumulator, while the lugs alongside it are bridged across and connect to the vibrator and filament circuits.

CHECKING THE SWITCH

It is possible that the relationship of the contacts to the wafer mounting holes may vary from that shown in our drawing, so do not accept this as a guide to identifying individual lugs. Seek, rather, to identify each lug which makes permanent contact with a sliding shoe and the other individual lugs to the contact is made as the switch is rotated.

As a further check the switch can be rotated to the extreme clockwise position, and the wiring examined in detail for each bank to make sure that the aerial, plates and grids are all connected through to the short-wave coils. Likewise, in the centre position, the leads should be connected through to the broadcast coils, while all circuits should be open on the anti-clockwise position.

A further point of note is in regard to the placement of the trimmer condensers. In an ordinary broadcast receiver the trimmers can be mounted either directly across the coils or soldered across the individual sections of the tuning gang. In a dual-wave set, however, separate trimmers are necessary for each wave band, so that a trimmer must be connected in parallel with each individual coil.

THE TRIMMERS

In this set no undue difficulty will be encountered in placing the trimmer condensers, provided they are not too bulky. The broadcast trimmers are simply soldered between the "G" terminal or wire on each of the broadcast coils and a convenient earth point. But make sure that you earth

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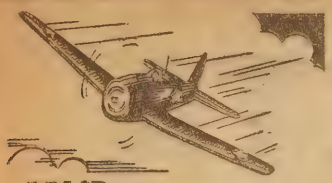

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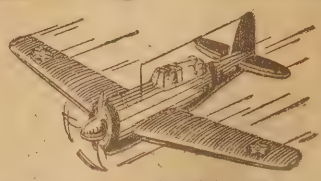

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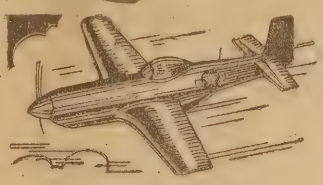

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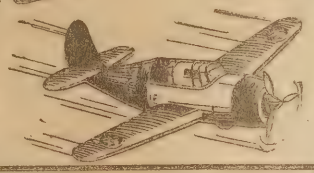

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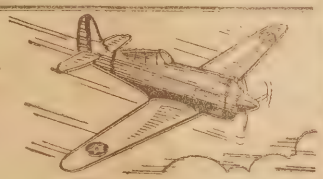

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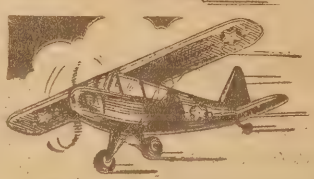

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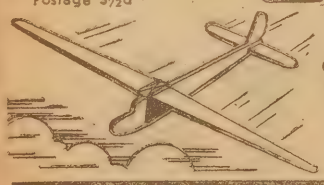

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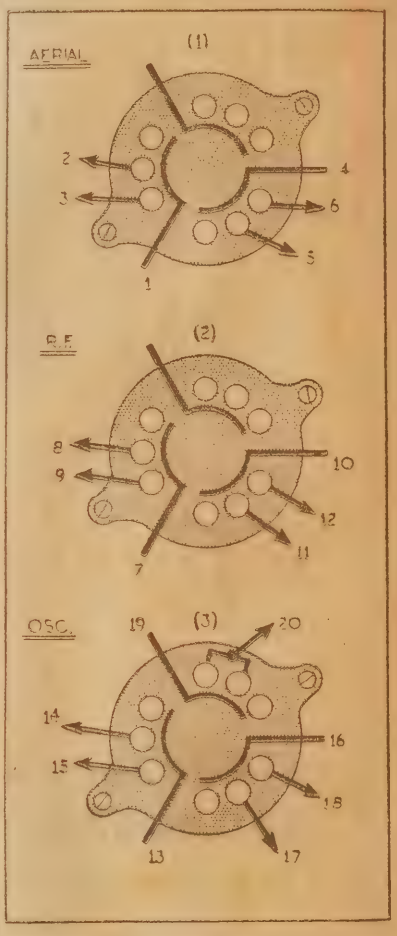
NEW STANDARD RADIO
103 HUNTER ST., NEWCASTLE

the outer plate of the trimmer to avoid mistuning when adjustments are made with a metal-blade screwdriver.

The placement of the short-wave trimmers is likely to be more of a problem, but these were installed in the original set in between the wafers of the wave-change switch. One side of the trimmer was soldered directly to the switch lug connecting to "G" on each side of the short-wave coils. The other lug of each trimmer was connected to an earth busbar which was run, for convenience, between three unused contacts on the switch. There is no objection to using spare



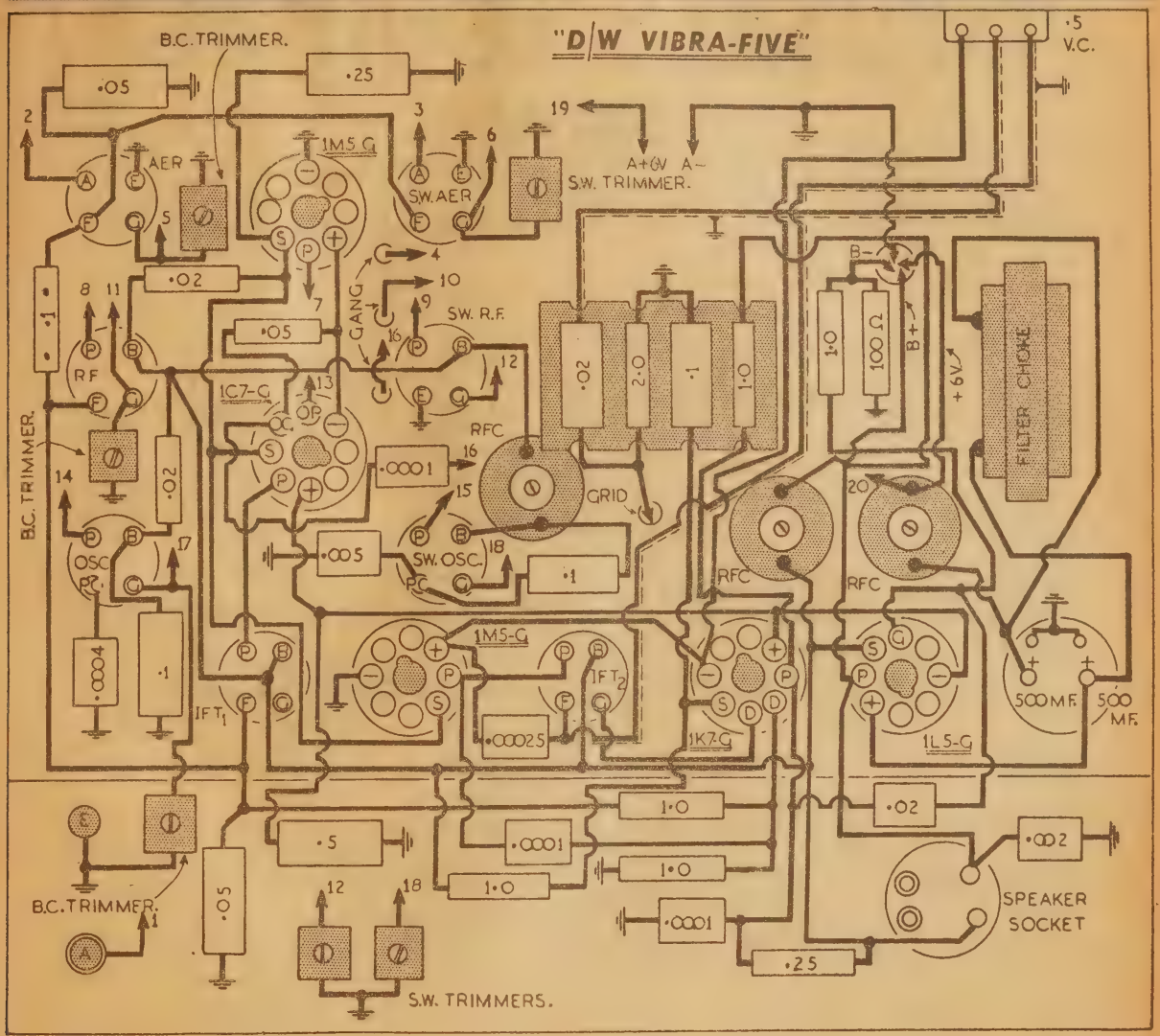
Used in conjunction with the wiring diagram opposite, this should assist greatly in wiring up the wave change switch.

contacts as anchor points, provided no supply voltages are shorted out in any position of the switch.

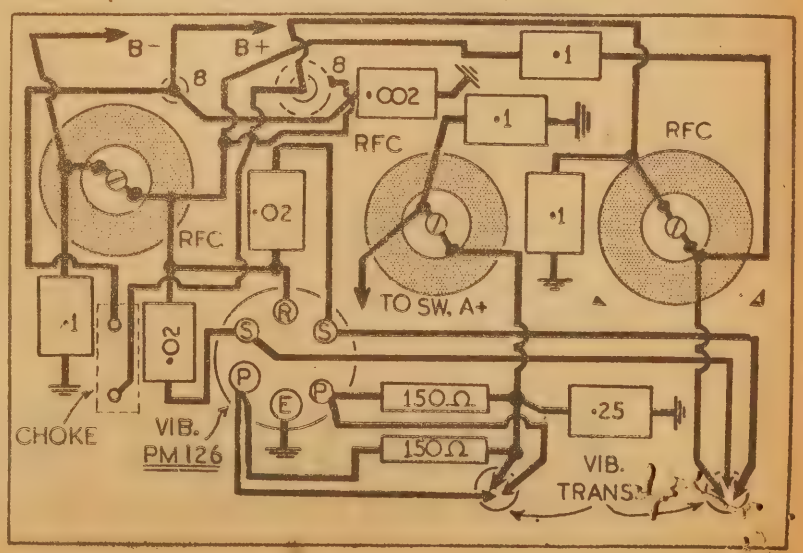
Reverting to the schematic circuit it will be noted that the electrical connections for the short-wave and broadcast aerial coils correspond exactly, the aerial in both cases returning through the primary to earth, and the grid to the same A.V.C. feed point. In the R.F. coil the primaries are connected in similar fashion but, whereas the broadcast secondary returns to the A.V.C. line, the short-wave secondary returns direct to earth.

The oscillator coils have different padder values for each band, the broadcast padder being .0004 mfd and

UNDERNEATH WIRING OF D-W VIBRATOR SET



Here is the underneath wiring diagram of the receiver. The various "hot" leads from the coils are numbered to correspond with the switch diagram on opposite page. Also the contacts to switch the receiver off and on. The underneath wiring diagram of the vibrator unit below remains unchanged from last month.



the short-wave padder .005 mfd. On the broadcast oscillator coil the feed-back winding returns to B-plus through a 20,000 ohm resistor, an arrangement which gives adequate grid current with good economy. However, the short-wave feed-back winding returns to B-plus only through an R.F. choke, with a separate 0.1 mfd by-pass condenser going to the "hot" side of the padder. This padder feed-back scheme was adopted to ensure best possible results from the 1C7-G on short-wave. In practice the oscillator grid current is rather lower than one may wish for, but quite high enough to indicate reliable oscillation and to ensure good results.

Tested with the vibrator power supply, as described for the broadcast version, the receiver performed well, with only the faintest trace of "hash" on a couple of spots on the short-wave band. This was traced to a residual interference voltage on the high tension line and, to eliminate it completely, an extra R.F. choke was placed in the high tension output line, but external to the power unit box.

(Continued on Page 75)

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- 12 of each of the following resistors.
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  - 1000 ohms. 1-3 watt.
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  - .25 megohm 1 watt.
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- 3 ½ megohm. potentiometers.
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A Universal Test Loudspeaker

THE value of this feature will be immediately obvious to anyone who has had much to do with service bench testing. Sets come in without loud speakers and one needs continually to be improvising or changing plugs to suit their varying requirements. The necessity for this disappears with the installation of a universal test speaker and the time necessary for its construction is soon repaid.

A versatile system of pins and sockets makes it possible to vary the plug connections quite simply, while field coil and load resistance values can be selected by turning a couple of switches. The output can be fed to a small speaker, if desired, or to a larger and well baffled speaker for quality checking purposes. The effects of varying the field coil or load resistance values can be observed immediately.

WELL-TRIED DEVICE

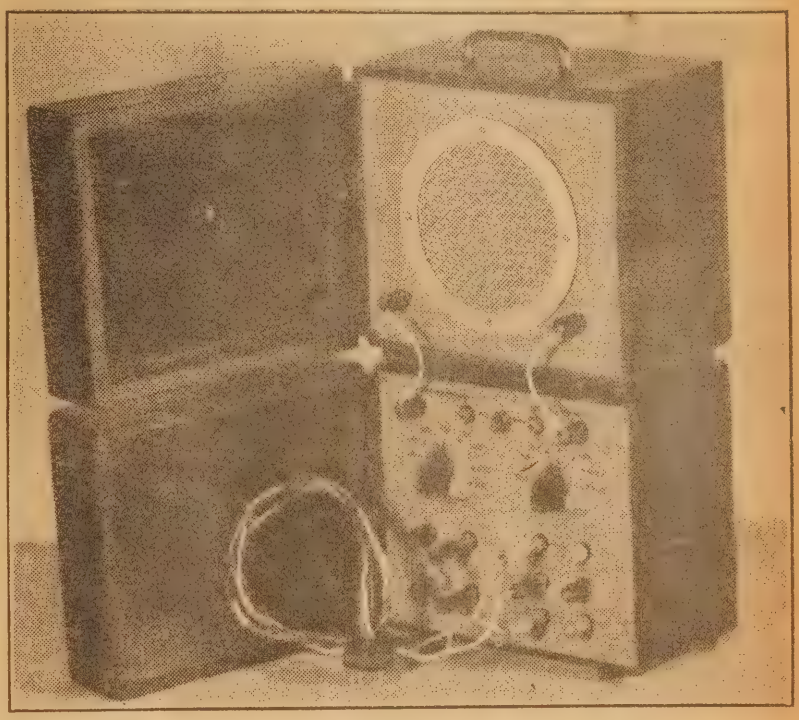
The universal speaker idea is by no means new, although the mechanical and electrical details may vary greatly. Under special circumstances one can simplify the design to meet known requirements but, for general service work on all types of receivers, the more versatile the instrument the better.

Back in December, 1942, we designed and described a unit of this nature, which has since proved very popular with servicemen and enthusiasts. The original unit has been in use in our own workshop ever since and has proved entirely satisfactory. We have thought quite a lot about the subject in the meantime but have found no reason to vary its basic design.

Fortunately, however, it is possible to be more definite in the way of mechanical specifications. When the original unit was designed, chasses, aluminium and cabinets were out of the question and we had to compromise by building the unit up inside an oddment radio chassis, with a false panel of masonite. Even the resistors necessary for the dummy field coil were frozen and had to be "scrounged" from other equipment.

Just now the supply position is far from happy, but the future is bright enough to fix on a definite mechanical layout and to make available blueprints and circuits on that basis.

This time we have used an aluminium panel 7in. x 8in. On this is mounted seven pin jacks and seven terminals which provide ready access to the dummy field coil and to the output transformer. The purpose of these individual pin jacks and terminals is explained elsewhere in the article.



We built our units in two boxes of the same size.

The problem of adapting loudspeakers to suit receivers under test is solved once and for all by this universal loudspeaker unit. While it is neither expensive nor difficut to construct, it can be set up in a few moments to meet the requirements of almost any ordinary receiver or amplifier.

PARTS LIST

- 1 Panel 8" x 7" (aluminium or steel).
- 1 Aluminium strip 8½" x 2¾".
- 1 Output transformer (Ferguson U1 or similar).
- 1 Permagnetic loudspeaker, 2.3 ohm voice coil.
- 1 100 or 125MA choke.
- 2 12 x 1 rotary switches.
- 1 S.P.D.T. toggle switch.
- 7 Terminals
- 7 Pin jacks.
- 9 Banana plugs to suit
- 1 4-pin plug
- 1 5-pin plug.
- 2 Pointer knobs.
- 1 Resistor strip (12 positions).
- 1 Case to suit unit (see text or blueprint).

RIGIDITY

Use of a metal panel makes for rigidity but does necessitate insulating of pin jacks and terminals. If you have strong feelings in the matter there is no particular objection to using a bakelite or masonite panel but, in this event, it would be wise to bond electrically the frame of the transformer, choke and switches, so that they can be earthed if necessary. It sometimes happens that a receiver or amplifier on the verge of oscillation will prove unstable if too much un-

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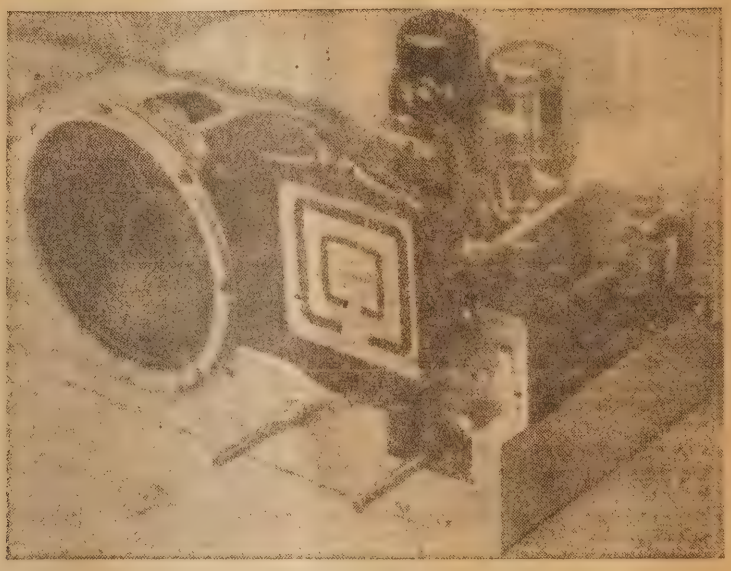

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Simplicity of construction is one of the most attractive of the many outstanding features of this compact foundation kit. Efficient in design and layout, it is so simple in principle that any beginner can use it, to build a receiver, with every confidence. Each part is guaranteed and matched; each unit aligned and tested; ensuring reliability of performance and reception. Full circuit and construction details are included with each kit.

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earthed equipment and wiring is present in the output plate circuit.

If you do decide on the metal panel, as in the original, remember to purchase sufficient bakelite or washers or insulating pushers for all the pin jacks and terminals.

PIN JACKS

The layout diagram of the instrument is drawn to scale and gives a fairly clear idea of just where all the components fit in. However, full-scale blueprints will be available by the time this article appears in print and these will show the exact panel layout, together with dimensions of mounting brackets, cabinet, &c.

Viewed from the front, two pin jacks and two spring terminals for the field connection are at the lower left of the panel, while three pin jacks and three terminals connecting the transformer are to the right. Each terminal is wired directly across to the pin jack alongside it, so providing an alternative method of connection to the field coil and the transformer. The spring terminals are always very handy for connecting output meters, volt meters, &c., for measurement and alignment purposes.

When the pin jacks and terminals have been mounted in place and wired as shown in the circuit, a metal sub-bracket is bolted in place carrying the special output transformer and the filter choke.

The rotary switches S1 and S2, which select the field coil and load resistance values, are mounted above the respective sets of terminals, while the voice coil connections are ranged along the top of the panel. A toggle switch S3 set between the voice coil pin jacks allows audio output to be fed either to a voice coil or to a 2.3 ohm resistor.

RESISTORS

The high wattage resistors, which form part of the dummy field coil, are ranged along the length of bakelite mounting strip which is fixed in turn by long bolts to the front panel.

The whole arrangement is mechanically rigid and a far cry from the rather makeshift construction which was forced upon us when the earlier unit was described.

Electrically, the unit must simulate characteristics of any loud speaker normally used with radio receivers and amplifiers.

Referring first to the field coil circuit we used a 12-position rotary switch for S1, this being a fairly standard item of equipment. The whole 12 positions are not strictly necessary but, since they are available, the field coil wiring has been arranged to take advantage of them.

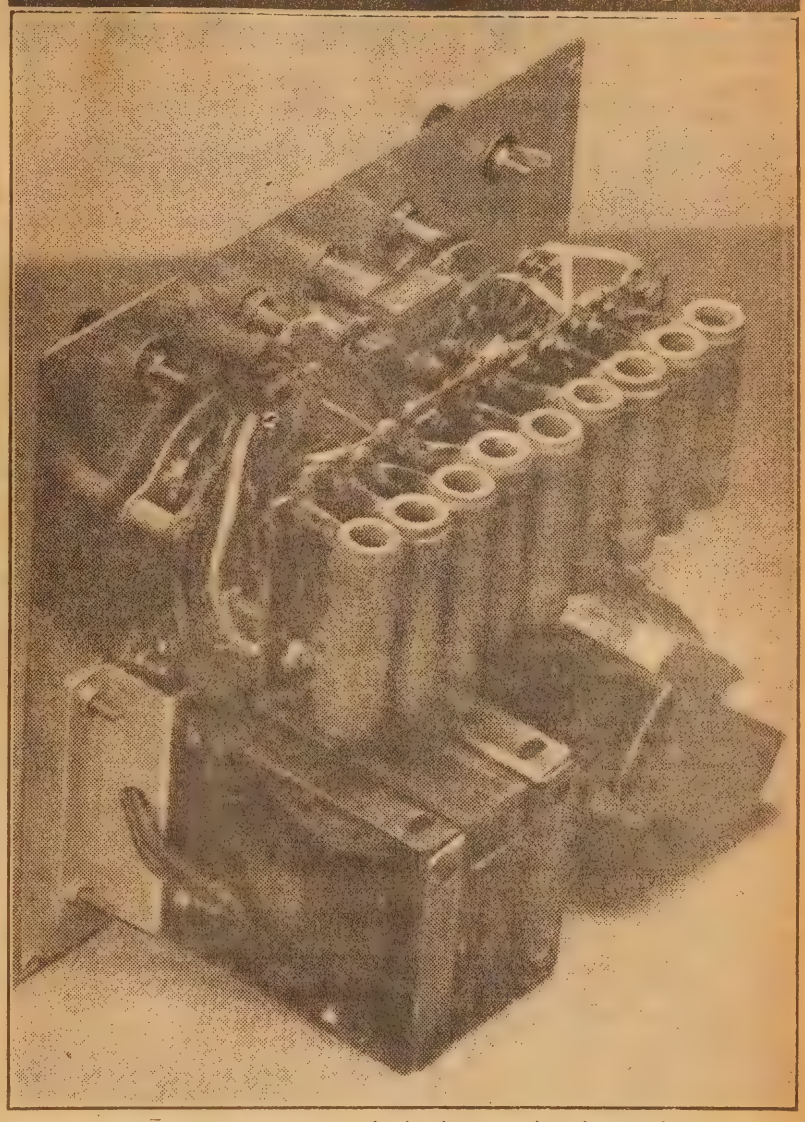
In the first switch position the field coil terminals are open circuited while they are shorted out on the next.

The third position brings into circuit a heavy duty filter choke with a 10 watt series resistor to make up the total d-c resistance to 250 ohms. There is no particular virtue about this latter figure, except that it is a fairly typical one for d-c choke resistance.

Resistor R2 is rated at 500 ohms so that position 4 on the switch represents a 750 ohm field. This is the first really important field coil value and, in selecting resistors R1 and R2, every effort should be made to see that the nett series resistance is as near as possible to 750 ohms.

Successive positions of the switch introduce into circuit resistors R4 to R9 which give effective field coil values of 1000, 1250, 1500, 2000, 2500, 5000 and 7500 ohms. It is very seldom in practice that one encounters loud speakers with field coil values differing radically from one or other of the above.

THE REAR VIEW OF TEST UNIT



The resistor mounting is clearly shown in this photograph.

COLOR CODE

Here is the color code for the output transformer.

PRIMARY: Outside leads green, centre tap red.

SECONDARY:

Common	red
2500	green and knot
5000	yellow and knot
7000	black and knot
10,000	brown
14,000	green
20,000	yellow
30,000	black

WATTAGE RATINGS

All these resistors in the original instrument are rated at 20 watts dissipation, so that there is little danger of them overloading or burning up with the current passed by the normal receiver or amplifier filter system. We used only a 100 milliamp filter choke but, if you can manage to obtain and instal one rated more liberally, so much the better. In an instrument like this, which is likely to see many years of continuous service, we feel that a little extra trouble and expense at the outset are justified if it will ensure consistent and trouble-free operation.

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"For FM and AM"

For That Midget Personal or Portable Radio

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The smallest 2 Gang ever produced in Australia.

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We carry all radio stocks including parts for the "SPRING-TIME PORTABLE", i.e. Loop Aerials, Minimax Batteries, ¼ and ½ watt resistors, and IT4, IS5, IR5, 3S4 valves.

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We manufacture and repair to specifications, AMPLIFIERS, COMMUNICATION RECEIVERS, TRANSMITTERS, etc.

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WRITE DIRECT TO:— F. N. RADIO "FOR FM AND AM"

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265 Military Road, Cremorne

Apart from this there is little else to say about the field coil circuit. It is simply a selected number of resistors wired in series with a filter choke to simulate the inductance and resistance values of speaker field coils.

The portion of the equipment involving the output transformer is rather more complicated. Three pin jacks and three terminals in parallel with them connect respectively to the ends and to the centre tap of the output transformer primary winding. No switching whatever is included in the primary winding, all impedance adjustments being effected in the secondary circuit.

USE WHOLE WINDING

With a push-pull audio system, both ends and the centre-tap of the primary are used in the ordinary way, the plates connecting to the ends of the winding and B-plus to the centre-tap.

With a single-sided output system, the plate connects to one end of the primary winding and B-plus to the other, the centre-tap being ignored. The transformer is designed to work with either balanced or unbalanced d-c components through the primary winding.

The true load for the output valve or valves is represented by the loud speaker voice coil, but the output transformer steps this up to several thousand ohms by a ratio which is equal to the square of the turns ratio.

YOU can obtain a full-scale blueprint showing the panel layout, sub-bracket resistor strip and carrying case for 2/6. Address your letter to the technical Editor "Radio & Hobbies," Box 2728C, G.P.O. Sydney, and endorse the envelope "Blueprint."

The special output transformer used in this instrument has a multi-tapped secondary winding and the load impedance reflected by the primary is varied by the simple expedient of switching the loud speaker voice coil across more or less of the secondary turns. When connected across the least number of turns, the impedance ratio is greatest and the reflected primary impedance at a maximum.

LOAD VALUES

It is obviously impractical to provide for all the load impedance valves, which may be required by different valves and operating conditions. However, the load presented by a loud speaker is not a particularly constant or predictable quantity so that some compromise can be tolerated.

For this unit we have provided for seven convenient and typical load impedance valves which meet most requirements. These are 2500, 5000, 7000, 10,000, 14,000, 20,000 and 30,000 ohms. These figures refer in all cases to the impedance across the whole primary winding irrespective of whether the centre-tap is used or not.

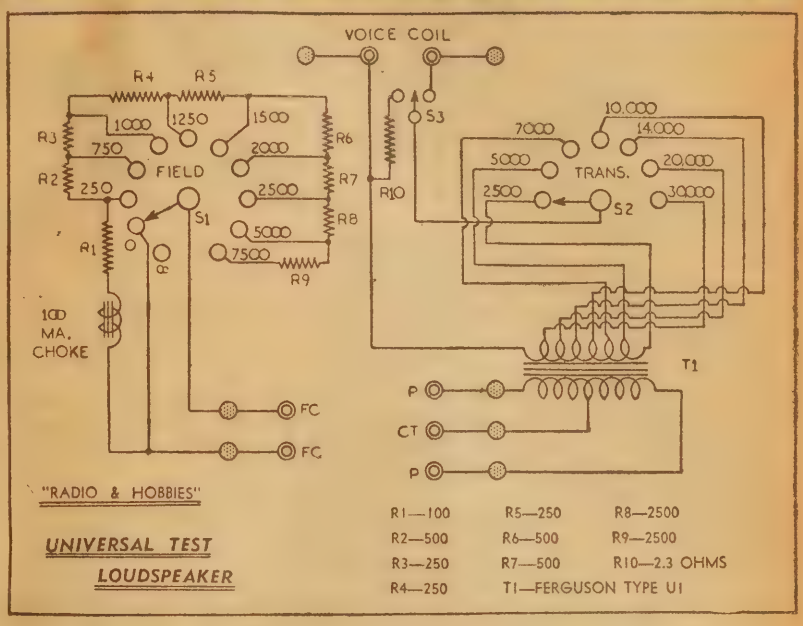
In passing it may be mentioned that the impedance between centre-tap and either outside pin jacks is one-quarter of the total impedance reflected by the whole primary winding.

Referring to the electrical circuit, it is seen that seven positions of a rotary switch S2 are used to select the required load impedances, and, in the original instrument, we used a standard 12-position switch. One voice coil terminal is connected permanently to the common secondary lead, while the second one is connected to the appropriate transformer tapping via the rotary switch.

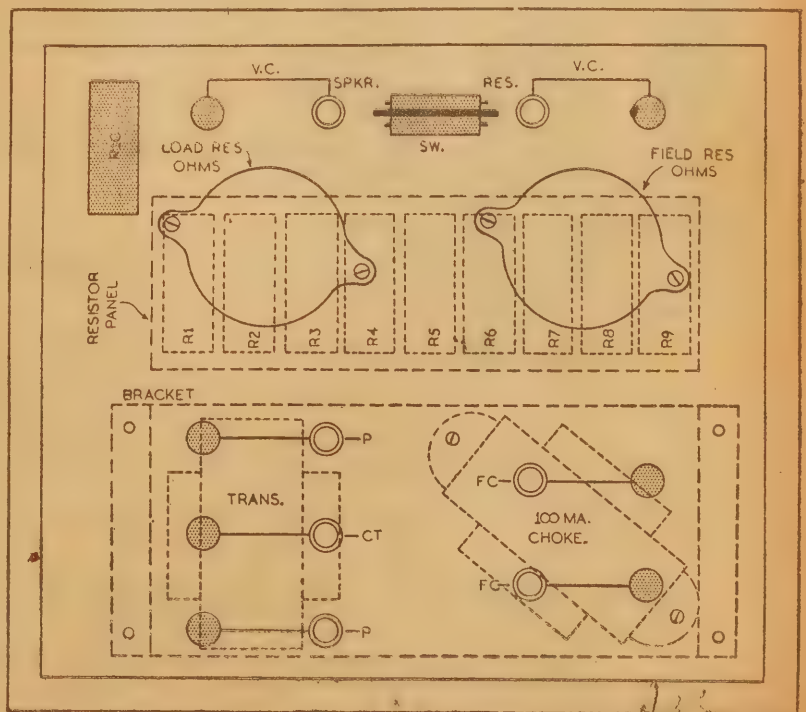
The particular transformer used in the original instrument was manufactured by Ferguson's Radio, and is designated as type "U1." It is designed to reflect the aforementioned primary loads when a loud speaker voice coil of 2.3 ohms is connected across the respective secondary tappings.

Use of any other loud speaker voice coil impedance will cause a proportion-

CIRCUIT OF THE TEST SPEAKER



The circuit of the speaker unit.



This half-scale diagram shows the layout of the front panel and the major components, as viewed from the rear.

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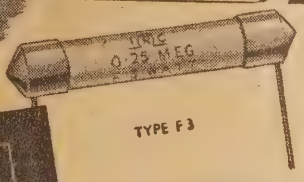
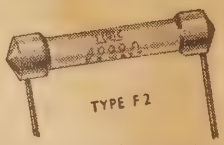
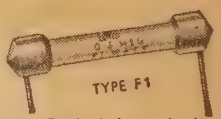
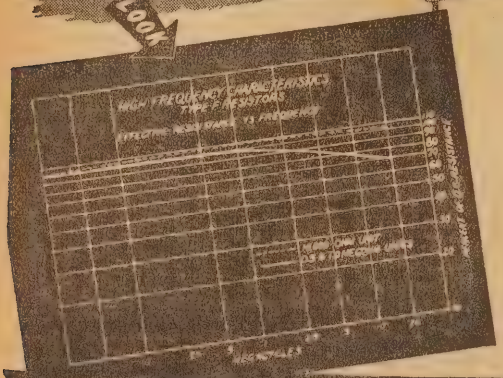
IRC

TYPE F Metallized RESISTORS









The Metallized filament is enclosed in isolantite body. Contact is made by moulding the ends of filament and terminals integrally in a special metal alloy. Completely enclosed contacts and non-hygroscopic body protect the units against abnormal atmospheric conditions.

CHARACTERISTICS.

TEMPERATURE CO-EFFICIENT. .02 per cent. C, for low ranges to .05 per cent. C. for high ranges.

VOLTAGE CO-EFFICIENT. 0.0 per cent to .01 per cent. per volt.

OVERLOAD 50 per cent. to 100 per cent. may be applied with nominal changes and return to initial values.

FREQUENCY. The resistance film on a glass form of small cross-section and surrounded by a low loss dielectric provides the ideal combination for ultra high frequency applications. The effective resistance of low values remains constant up to 20 Megacycles, as shown on graph.

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AND A

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ate increase or decrease in all reflected primary load.

When the 2.3 ohm voice coil is connected across the entire secondary winding, the reflected primary impedance is 2500 ohms. Connection across progressively fewer turns allows the reflected primary impedance to increase to a maximum of 30,000 ohms. Considerable care is necessary when wiring the switch, to see that the tappings are connected up exactly as shown in the circuit diagram.

RESISTANCE LOAD

The toggle switch S3 allows the audio power to be fed into a resistor R10 instead of the test loud speaker. For fading tests, the receiver can be left on an output tone from the modulated oscillator, with an output meter or a-c voltmeter registering the output. One can carry on with another job in the meantime in comfortable silence, an occasional glance at the meter showing whether the output is varying.

Resistor R10 should have a resistance as near as possible to 2.3 ohms and be rated to dissipate from 5 to 20 watts. We used two 4.5 ohm 3-watt resistors in parallel, giving a net value of 2.25 ohms at 6 watts.

The voice coil output leads are taken to a pair of pin jacks and also to a pair of spring terminals connected in parallel with them. In the normal way, the test speaker leads would be clipped into the spring terminals, leaving the pin jacks available for possible connection to the cable from the receiver or amplifier under test.

The provision of these plugs and cables completes the electrical construction unit.

You will need a 4-pin speaker plug to begin with and a few feet of good quality hook-up wire in three colors.

Two black leads, each about 24in. long, can be soldered into the large pins of the 4-pin plug, representing the normal field coil wires. Then, say, two blue or green leads to the small pins for the transformer connections. Twist or plait the leads, leaving about nine inches free and terminate the ends with banana plugs.

CODE FOR PINS

To avoid possible confusion at a later date, it is a good plan to spot near the pins of the plug and the tips of the pin jacks and terminals with distinctive colors.

A five-pin plug and cable will also be needed. This time the black field wires go to the two pins representing the heater connections on the normal 5-pin valve base. The pins to either side would be wired with blue or green, while the pin out on its own could be wired with red hook-up. As before, spot the pins with lacquer, and you will avoid the necessity for feats of memory in identifying later which lead is which.

Most receivers use a 4-pin speaker socket, with the plate and field circuits connecting respectively to the small and the large pins. It is the work of a moment to push the banana plugs into the appropriate pin jacks.

(Continued on Page 75)

Get it at
JOHN MARTIN'S

Your University Multimeter Kitset

Build this Multimeter yourself

This new kit can be easily constructed in any home with a few simple tools, such as a screwdriver, soldering iron and a pair of pliers. It is an A.C.D.C Multimeter kit in a handy carrying size of 6 inches by 8 inches by 2½ inches with leather carrying handle. It is housed in a black brocade finished steel box with etched brass labels in black and nickel.

The ranges are 0/10, 0/50, 0/250 and 0/1000 volts D.C., 0/10, 0/50, 0/250 and 0/1000 volts A.C., 0/10, 0/50, 0/250 and 0/1000 output volts, 0/1, 0/10, 0/50 and 0/250 milliamperes D.C. and 0/1000 and 0/100,000 ohms D.C. The 1000 ohm range is particularly helpful in checking open circuits and short circuits in coils and I.F. transformers. The last division on the 1000 ohm scale is a quarter of an ohm. Only one standard type battery is used, and the sensitivity of the instrument is 1000 ohms per volt.

All wiring instructions and constructional details are given with the kit, and photographs and circuit diagrams make it easy to assemble the instrument. All parts are prefabricated so that fitting is easy, and everything is supplied, including the wire, panels, solder lugs, etc.

Country readers write for fuller particulars.

JOHN MARTIN PTY. LTD.

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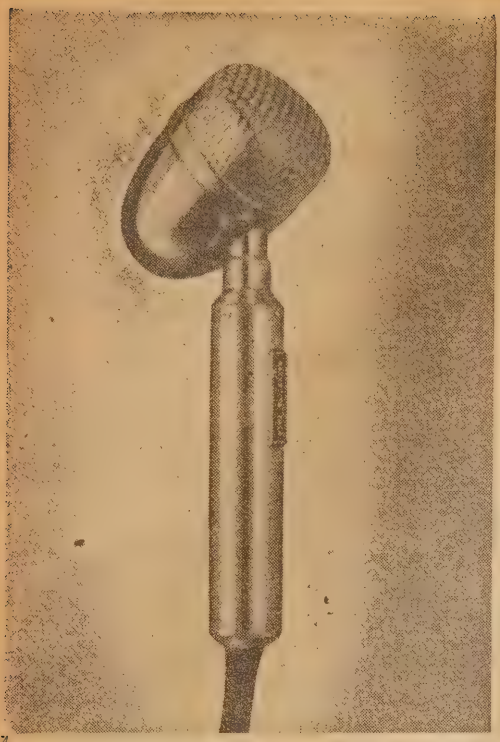
Telegrams: "Jonmar."



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Suitable for Airports, Police, Fire Brigades, Experimental Radio Stations, or any application where a light weight, portable moving coil microphone with high output and excellent frequency characteristics is required.

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Chrome perforated cage and handle with in-built "press to talk" switch rotatable left or right through 90 deg. to suit left or right handed operator.

Generator—
Floating movement incorporating Alnico magnetic system and acoustic compensator. Alumina embossed diaphragm and 50 ohm moving coil mounted on replaceable diecast case; self-centred surround.

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52 db. below .006 watt (1 volt per bar) 50 ohm at 400 cps. or 42,000 ohms with mu-metal in-built transformer.

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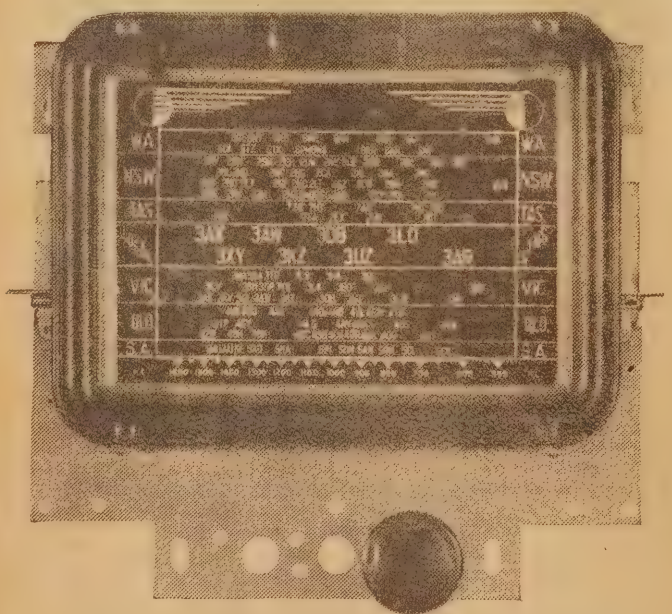

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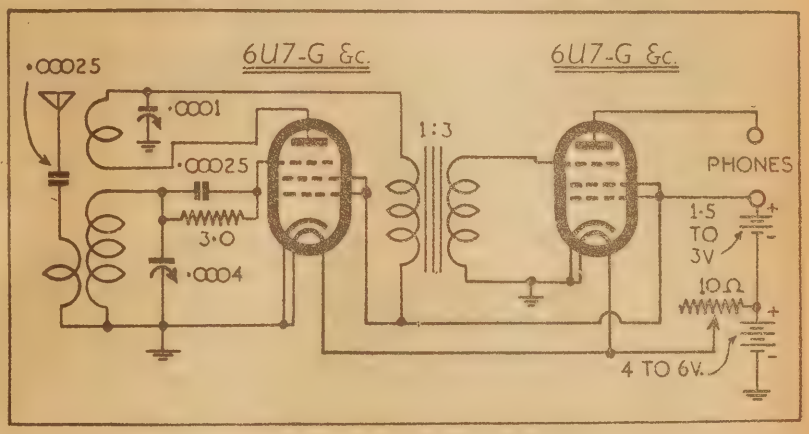
A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

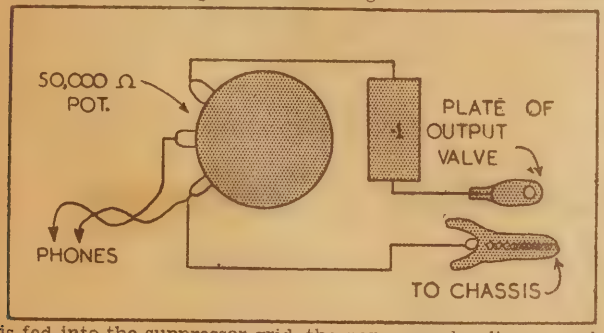
THIS NOVEL SET REQUIRES NO B-BATTERY

Since it first appeared in an overseas publication some years ago, a novel two valve receiver circuit has frequently been referred to by our readers. Mr. R. Johns of Crystal St., Sutherland, NSW reports good results from the circuit and suggests that we publish it for the interest of other experimenters.



HE reports that, when used in conjunction with a good aerial, the set proves very effective with local stations.

At first glance the circuit is conventional enough but a point of note is that the input signal in each stage is fed into the suppressor grid, the normal screen and control grid being tied together and returned to a small positive potential. This arrangement, which is reminiscent of the very earliest tetrode practice, allows them to operate with a very small high tension supply voltage..



The heaters of the valves are operated through a 10 ohm series rheostat from a 4.0 to 6.0 volt source. In the interest of economy, the voltage across the heaters should be kept as low as possible consistent with satisfactory regeneration. An extra potential of from 1.5 to 3.0 volts is connected between the positive side of the filament battery and the plate supply, so that the effective high tension voltage with respect to ground is from 6 to 9 volts.

The circuit is applicable to any of the RF amplifier pentode valves having the suppressor brought out to a separate base pin. It is unfortunate that this procedure is not adopted for battery type valves, since low consumption filaments would add materially to the advantage of the circuit.

* * *

Another useful circuit hint sent in by Mr. Johns shows a simple method of operating headphones in conjunction with the loud-speaker of an ordinary domestic receiver. The circuit requires only a 0.1 mfd 600 volt condenser, a 50,000 ohm potentiometer and a couple of clips and terminals.

Obtain a small spade clip, or make one from a scrap of metal, and drill a hole through it which is a snug fit for the plate pin of the output valve. Solder a length of hookup wire to it and connect up to the condenser and potentiometer as shown. It is a good scheme to mount these components on a small metal bracket which can be attached to the rear of the cabinet.

Slip the output valve from its socket, push the spade clip over the plate pin and re-insert it. Make sure that the spade does not short across to an adjacent pin or touch the chassis. A half-inch of spaghetti tubing will prevent this occurring.

Clip the other lead to the chassis and connect the phones. You will find that more than adequate volume can be obtained from the phones with the receiver operating at normal room strength. By turning the receiver volume down and advancing the phone potentiometer, very little sound at all need be heard from the speaker.

But be careful and don't leave the controls set that way. Otherwise, the next person to use the set may turn the speaker-volume well up and blast your phones out of existence. Always make a practice of turning the phone potentiometer right off before you put the phones away.

SILVER PLATING MADE EASY

COPPER WIRE and copper strip can be silver-plated without need for electrical circuits by rubbing on a paste made from silver chloride and cream of tartar. The quantities and purity of either ingredient is not at all critical.

The silver chloride is not stable in the presence of light, but is easily made. Either use two or three crystals of silver nitrate (lunar caustic) dissolve in water, or dissolve a scrap of silver (threepenny piece) in nitric acid and dilute the remaining fluid with water. Add to this a solution of common salt in water, which should precipitate the white chloride.

When this settles, pour off the excess liquid, then add clean water and shake up. Allow the chloride to settle again, pour off the water and repeat this washing process three or four times. Finally add dry cream of tartar to form a paste.

Clean the copper well, moisten with a salt solution and then rub on the paste with a soft rag. This forms a coating of silver (not quicksilver) which is permanent in its qualities.

Thickness of the finished coat depends on the amount of rubbing and the process can be repeated as many times as necessary.

(From R. Kerr, Longwood, SA).

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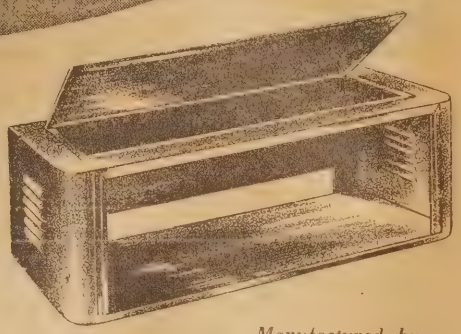

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TRADE REVIEWS AND RELEASES

EDMACO LABS. RELEASE NEW PRODUCTS

Edmaco Laboratories of 333 George-street, Sydney, have recently announced two small receivers and a 5-inch permag. loudspeaker. These are available immediately through normal trade supply houses.

THE portable receiver employs four of the standard 1.4 volt "GT" series valves and operates normally from two 45-volt Minimax B-batteries and a 1.5-volt filament battery. Valve line-up is 1A7-GT converter, 1P5GT I.F. amplifier, 1H5GT deflector and audio and 1Q5GT output.

The sensitivity and signal pickup on the built-in loop is adequate for good reception up to 40 or 50 miles under average conditions and, for longer distances, the signal pickup can be increased by the addition of a temporary aerial and earth. Leads for these are brought out and anchored to the screws which hold the rear lid in place.

The receiver is housed in a leatherette-covered cabinet with carrying handle, the controls, dial and speaker grille being on the front. Power output and tonal qualities are good.

List retail price for the portable set is £22/10/- complete with new batteries.

A four-valve A-C mantel receiver from Edmaco (not illustrated) is possibly the smallest commercial set of its type at present on sale. It is housed in a leatherette-covered cabinet and sells for £17/19/6 list. Valve line-up is ECH35 converter, EBF2-G, 6V6-GT output and 5Y3-GT rectifier.

Of even greater interest at the present juncture is the release of a new 5-inch permagnetic loudspeaker, as illustrated. The speaker has an Alnico magnet, die-cast housing and a specially treated cone. Power handling capabilities appear to be excellent, while the sensitivity also is adequate. The new speaker has a nominal voice coil impedance of 2.3 ohms, and transformers to suit are now being made available with primary loads of approximately 7000 and 15,000 ohms.

Marketed under the brand name of Soundproducts, the new permagnetic speakers will sell for 30/- list, not including transformer.

Edmaco Laboratories are at 333 George-st. Sydney. BW6164.

HEADPHONES

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130 ohms impedance .. .. 10'-

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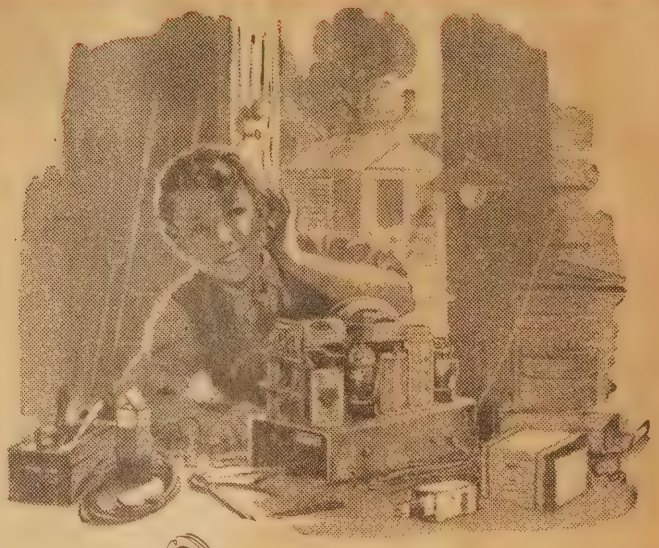
A 4-valve Broadcast kit assembly which has even more features than the "Little Companion!" The Metropolis 4, illustrated below, is supplied complete to the very last nut and bolt and Aegis-engineered to ensure trouble-free assembly and trouble-free radio enjoyment. See this sensational kit soon—all its features are attractive—its simplicity, its appearance and its price.



METROPOLIS 4

KIT ASSEMBLY KS4/B

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Complete Parts Retail incl. Sales Tax.

£11/17/6

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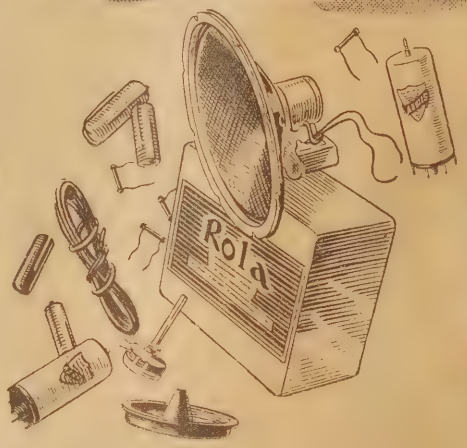
Plus Valves £3/12/7



FEATURES include

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- ★ ROLA SPEAKER with new Anisotropic Alnico.
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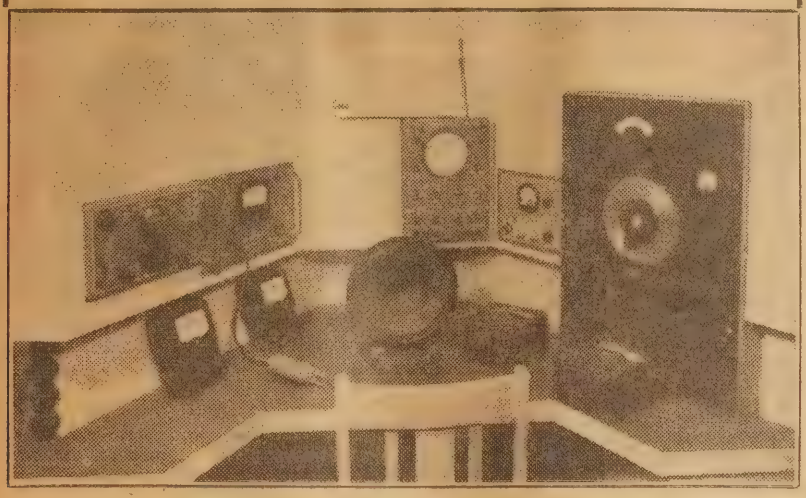

One of the two testing bays in the new AWV Applications laboratory. Instruments are set into panelling and grouped in planned fashion around the test bench.

A new applications laboratory has recently been set up at the Head Office of the Amalgamated Wireless Valve Co. at 47 York-street, Sydney. Under the supervision of Mr. F. Langford-Smith, the Company's Application Engineer, the laboratory will be a further addition to the Radiotron Technical resources.

THE equipment so far installed includes the latest model AWA signal generator, 5-inch Cathode-ray oscillograph, beat frequency oscillator, output meters, and subsidiary equipment, with two high quality laboratory type multimeters and a number of ordinary volt-meters, milliammeters and microammeters. Distortion is measured by means of a general radio wave analyzer. Additional equipment is being built and purchased so as to extend the flexibility of the laboratory, this including v-h-f and f-m testing.

The equipment is grouped in two sections, one primarily covering radio frequencies, and the other audio frequencies, so that work on an audio frequency amplifier may be carried out simultaneously with that on a radio receiver.

A high grade laboratory type valve tester is now being constructed and will be used in the testing of valve characteristics. This will include laboratory type measuring instruments with provision for measuring all electrode currents and voltages, including positive and negative grid currents, mutual conductance, amplification factor and plate resistance.

In cases where the equipment of this laboratory is insufficient to meet special requirements, arrangements have been made for the use of certain apparatus from the company's laboratories at Ashfield.

The radio frequency and audio frequency equipment is installed in a screened room so as to be free from radio interference, and is capable of carrying out all normal tests on receivers and amplifiers. This equipment is used in the design of circuits published in Radiotronics and is also available to assist receiver manufacturers in tracking down faults in receivers, particularly those concerned with valves.

HANDY LIGHT FROM RADIO HOUSE

A DOZEN and one uses suggest themselves for a novel light now being marketed by Radio House Pty. Ltd., of 296a Pitt-street, Sydney.

It consists of a nickel-plated and threaded barrel, which can be mounted neatly through a single hole in a door, in the head of a bed, in an instrument panel or a variety of other positions which may suggest themselves.

The hollow barrel houses a small flashlight battery and a torch globe fits into one end. A nickel-plated hood covers the globe and pressing this with finger causes it to light up. Releasing the pressure normally switches off the light, but a twist locks it in the "on" position.

The light from the globe is sufficient to illuminate a keyhole, watch, meter face, &c. The unit lists at 13/6 and enquiries should be addressed direct to Radio House Pty. Ltd.

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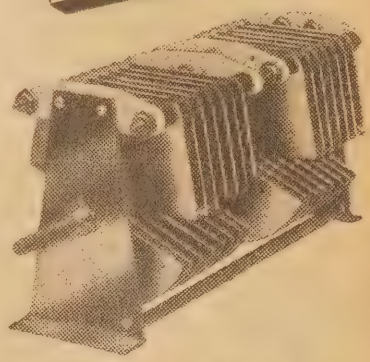

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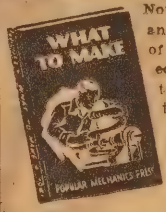

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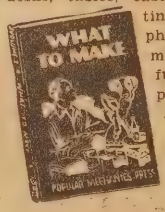

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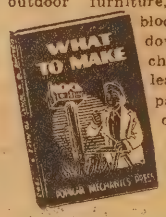

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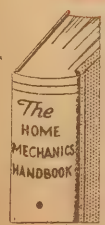

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TYPICAL EXECUTIVE U.S.A. PLANE

The dashboard of this aircraft is reminiscent of a high class motor car, and the general interior is comparable in the same manner.

The USA plans to attack the field for light, economical aircraft suitable for use by executives, charter flying, and private ownership. This article describes a typical model just released.

A HIGH performance, all metal, low wing monoplane, the Beech Bonanza has as its outstanding feature a Vee, or butterfly, tail designed to reduce drag and simplify production and maintenance.

Directed specifically at the charter operator and executive market, the Model 35, according to the company's anouncement, is capable of operating at a direct cost of 1½ cents per passenger mile, counting three passengers and a pilot.

These figures are based on 100 hours of use per month.

The plane will sell at 7345 dollars.

Powered by a six-cylinder, 165 Continental engine, the Bonanza has a top speed of 185 mph and a recommended cruising speed of 175 mph at 10,000 feet.

Normal loading includes four people of an average weight of 170lb. each, plus 100lb. of baggage and two well-sized compartments having a cubic compacity of 16½ cubic feet.

This payload is carried when the aircraft has sufficient fuel for an extreme range of 750 miles at an average cruising-speed of 165 mph, or at its top speed, 185 mph, over a range of 700 miles.

Two completely different aircraft were built.

One of them incorporated the laminar flow wing and the other included the Beechcraft version of the 23000 series NACA wing.

Both of these aeroplanes were flown extensively and finally the 23000 series NACA-Beechcraft wing was chosen for production on the basis of comparative tests.

It had equally great speed with the laminar flow wing and possesses many additional advantages.

Perhaps the next obvious thing about the Bonanza is the large size of the tyres and the long wheel base between the nose wheel and the two main wheels.

The tyres are made large in order to permit the aeroplane to utilise soft or rough fields without damage, and the wheel base is made as long as possible for the same reason and to reduce the load on the nose wheel and decrease the possibility of "galloping" on rough fields.

SPECIAL WHEEL DOORS

A unique provision is the closure of the main doors when the wheels are fully extended.

As the wheels are retracted the doors open to allow the wheels to pass into the wings and then close again.

When they are extended the same operation takes place in reverse.

The closed main wheel doors protect the doors against the buffeting of the propeller when the engine is run up on the ground and also prevents contact with obstructions or brush, or high grass as well as keeping the wheel wells clean.

A glance at the nose wheel discloses that it has ample side bracing and that it is free-swivelling.

A shimmy dampener of the hydraulic type is provided to guard against shimmy.

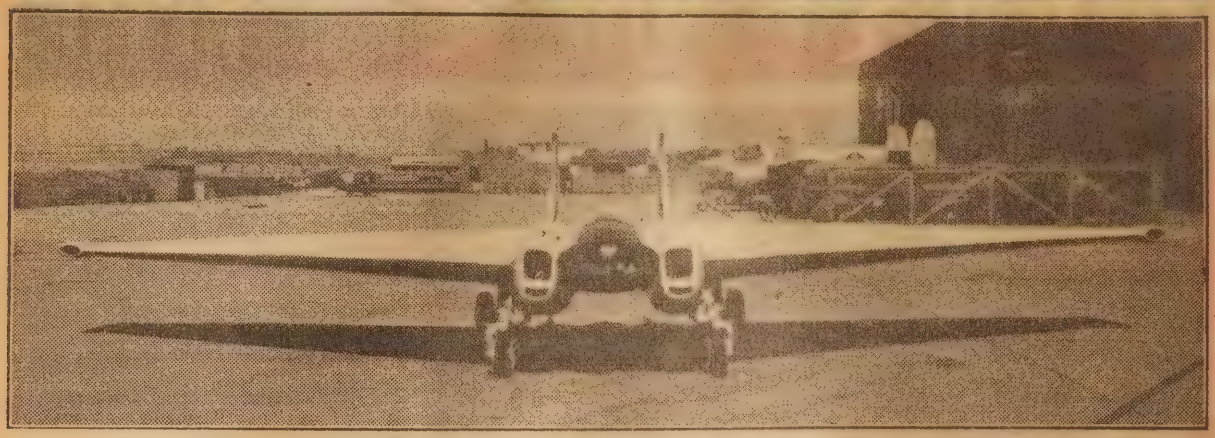
In the early stages of testing the Beechcraft Bonanza had a steerable nose wheel, but this was abandoned as a possible source of danger.

Comparative tests showed that the presents full swivelling nose wheel is a much more convenient arrangement which permits better manoeuvring in close quarters as well as eliminating the possibiilty of mishandling during a landing.

The nose wheel has a specially-designed mud-scraper to prevent mud

The features of the Bonanza as discussed in the article are illustrated at right.

TWIN JET-PROPELLED NORTHROP FLYING RAM



Small but lethal, the Northrop Flying Ram XP-79, is a twin-jet plane in which the pilot rides prone, to raise his "blackout threshold" and permit faster manoeuvres, more abrupt turns and harder pullouts from dives. Listed as capable of more than 500 miles an hour, the Flying Ram incorporates the clean Flying Wing design for which Northrop Aircraft, Inc. is famous. Flying Wings, Northrop designers say, are the ideal aeroplanes, since they are capable of high speeds, longer range and greater load because of the elimination of parasitic drag in the fuselage, tail assembly and engine nacelles. In the Flying Ram, the pilot and the engines are fully enclosed in the wing.

(Continued from Previous Page)

or stones from being thrown up against the bottom to the aircraft or forward into the propeller.

In the Bonanza's tricycle gear every attempt was made to conserve all the advantages of the tricycle gear and eliminate all of the disadvantages which have appeared in other aircraft.

In order to permit the aeroplane to take off quickly from soft fields, the design incorporates quite a considerable angle of attack of the wings when the aircraft is in the ground position.

This permits the wing to start lifting the aircraft out of the mud as soon as taxi-ing speed has been attained.

As the aircraft speeds up, the wheels offer less and less rolling resistance and permit the aeroplane to accelerate to flying speed in a short distance.

CONTROL PROVISION

Similarly on landing, the wings bear a considerable portion of the weight of the aeroplane until it has decreased its rolling speed.

Controls are of the throw-over type, with adjustment to two high positions at the option of the pilot, although dual control is available at extra costs.

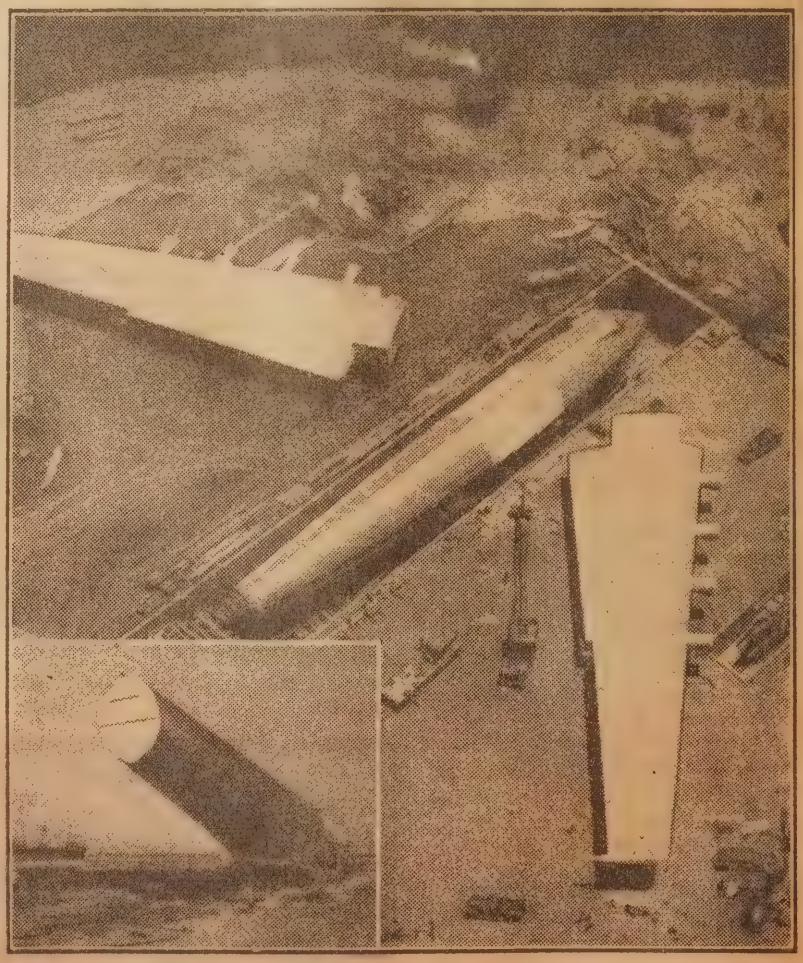
The right-hand rudder pedals may be folded out of the way.

The landing gear and flaps are actuated electrically, but an emergency manual control is available for the landing gear.

Most of the exterior surface of the Bonanza is flush riveted and finished in natural aluminium strips with painted area on top of engine compartment.

Among the other features of the plane are soundproofing, cabin loudspeakers, bad weather windows, retractable steps for entering and alighting, and also another prominent feature is the quick-removable petrol tank caps of expansion plug type.

SPECIAL DOCK FOR BIG FLYING BOAT



Snuggling in its graving dock, the Hughes Hercules in final stages of assembly. The air view above shows the wings being moved into position for attachment to the fuselage. Each wing float of the world's largest flying-boat requires an auxiliary dock. Towering above the main deck, the tail (inset) awaits installation of rudder and elevators. These pictures of the plane being assembled were made before channels to the harbor had been dug.

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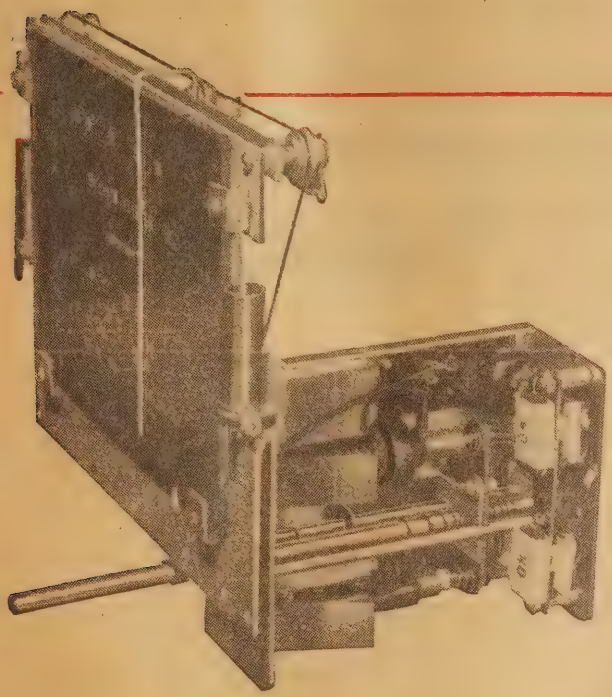

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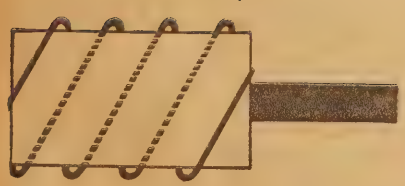

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GIANT AMERICAN LUXURY AIRLINER

Douglas Aircraft's new four-engined DC-7 Globemaster must be regarded as one of the outstanding additions to the long list of fine passenger airliners which have appeared since the end of world War II.

DESIGNED to bring economical air transport within the reach of the average man, the DC-7 has two cabins, one accommodating 72 passengers and the other 36.

The giant new plane was first announced late in 1944. It had its first successful test flights in May last.

Seven times larger than the standard DC-3's, this sleek new leviathan of the sky is appointed with the latest in passenger amenities as well as the most up-to-date navigational and flying safety devices. A modern galley equipped for serving full meals is included, as well as dressing-rooms, flight-deck and pilot's compartment.

PRESSURE CABIN

Air pressure in the fuselage is maintained at normal levels despite the fact that the plane may be flying at 20,000 feet or so, where otherwise shortage of oxygen in the atmosphere would make conditions uncomfortable for passengers.

The Globemaster is a low-wing monoplane with a tall, squarish single fin and rudder. Landing gear is of the tricycle type, the nose wheel swinging upward and forward for stowing in the nose. On the ground the plane has a slightly "nose-up" appearance due to the length of the nosewheel strut.

With a total weight of 72 tons, the Globemaster will be able to carry up to 30 tons of cargo at speeds of 300 miles an hour.

An interesting feature of the design is an elevator tray which normally forms part of the floor of the fuselage. This tray can be lowered when the plane is on the airfield, loaded with cargo, and then raised to floor level under power operation. Cargo is easily moved away and stowed within the roomy fuselage.

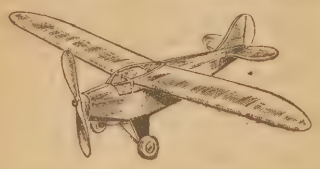
The machine is said to be capable of circling the globe with only two stops for refuelling.

ENGINES

Power comes from new Pratt and Whitney engines each driving a four-blade Hamilton Standard "super hydromatic" propeller.

When the Globemaster was on the drawing boards the designers claimed that the machine would fly passengers on international "hops" at fares as low as 3½ c. (2½d) a mile.

First organisation to place orders for the new aircraft was Pan-American World Airways, which announced that DC-7's would be used on Pan-American's trans-ocean routes.



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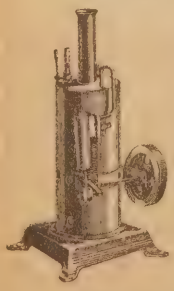

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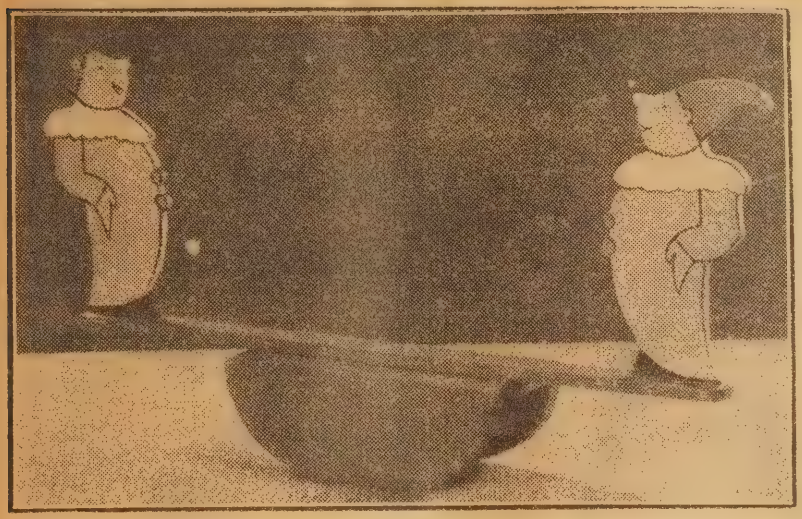
ROCKING TOYS FOR THE YOUNGEST



With red caps, white collars, yellow coats and red buttons, the two clowns are bright figures on their green see-saw.

Moving toys have an appeal of their own for all children. Simple rocking types like those illustrated are very effective. Having no intricate moving parts there is nothing to get out of order—hence they form an ideal plaything for the tiny tot.

MANY varieties of toys based on the rocking principle can be made but two types are suggested, one with a single figure, for example the sailor shown in the diagram, and the other with two clowns, the general arrangement of which can be seen from the photograph.

The Sailor. The rocker base is constructed first, and the simplest method of doing this is to make it up in three pieces. Any light, straight-grained wood will do and it will be found that the soft wood frequently used in the sides and ends of packing cases is just the thing. If it is rough, plane both sides until smooth.

CLEANING DOWN

This will also remove any lettering or any other marks on the wood. The planing must be done before the pieces are cut to shape. From your timber cut off two pieces 2in. x 2in. x ¼in. These are to be curved to a shape similar to that shown in the sketch. It is necessary to have these two pieces exactly the same shape and this would call for a great deal of skill if they were made separately, so the best thing to do is to nail them together, using fine panel pins. Two panel pins will be sufficient.

Leave the heads protruding about 1/8in. so that they can be pulled out with the pincers later on. Plane the top edge straight and mark out the shape on one face. Then saw them both to shape at once. If the wood used is soft, a fret saw will do this job well if a little care is taken. File up any rough patches and sandpaper the edges before the pieces are separated, taking particular pains to see that the curved edges are square and evenly curved and free from bumps. Join them together across the top with a piece of wood 6in. x 2½in. and about 2in. thick, which is glued and nailed in place.

The character figure is made of three-ply sawn carefully to shape with a fret saw then sandpapered smooth. If you are using a rough piece of plywood it is better to plane it before the figure is cut to shape, otherwise parts of it are sure to get broken. Notice the small tongue beneath each leg which are used to fasten the figure to the base.

Mark out and cut two small holes in the top piece to take the tongues on the ends of the legs. These can be cut easily and neatly by drilling through the wood and using this as a start to cut the rest with a coping saw. Temporarily fix the figure in position. Some care is needed here for it must stand exactly in the middle, otherwise it will not remain vertical and the rocking motion will not be regular. Place the toy on some smooth surface, say the top of a table, and give it a light tap with the finger to see if it rocks properly. If all is well then glue it in place.

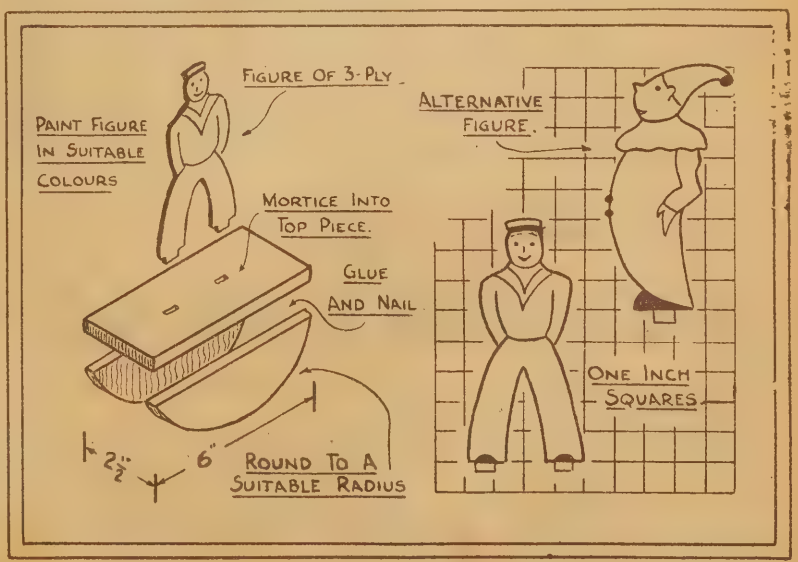
PAINTING

Clean up any rough or uneven patches with sandpaper and the finishing touches can then be given by painting with colored enamels, using white for the clothing and flesh for the features (white, with a small trace of red, will mix into a suitable color for this). Paint the rocker base green. When the main parts are dry, outline the details with a thin black line.

The Clowns. A similar toy can be made with two figures, say the clowns, as shown in the photograph. One rocker base is required and make it the same pattern as that for the sailor, but notice that there is a cross arm on which the figures are mounted. This is made from a light piece of wood about 14in. long and ¾in. thick. An inch in width will be found to be sufficient, so a small piece of wood, such as that used in lattice work, will suit nicely. Plane it up and smooth with sandpaper and round the ends to a pleasing shape.

Cut two figures similar to the clowns

(Continued on Page 76)



This drawing shows you how to lay out the figures.

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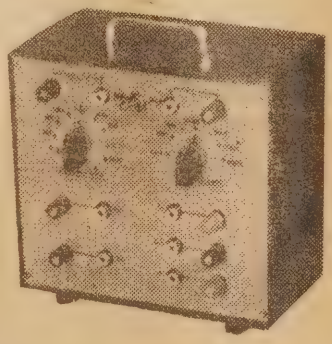

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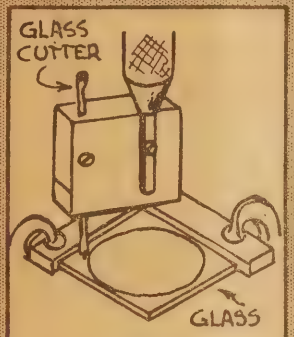
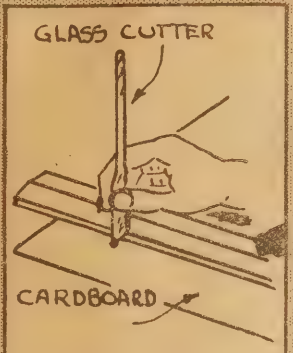


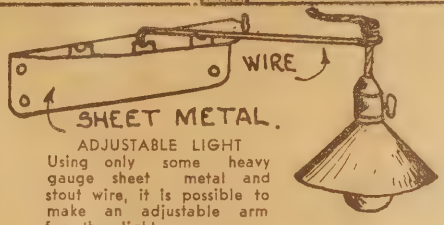
CIRCLES FROM GLASS

Drill a hole through a small block of wood to take the glass cutter. Fasten the other end of the block at the required radius to a mandrel held in the drill chuck. In using, operate the drill press by hand.



SCORING CARDBOARD

There is little chance ot accidently cutting through the work, and an almost perfect job can be made of scoring cardboard if a glass cutter is used instead of the conventional knife

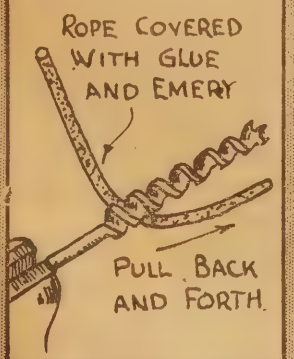


ADJUSTABLE LIGHT

Using only some heavy gauge sheet metal and stout wire, it is possible to make an adjustable arm for the light over your work bench. Clips bent up at intervals hold the arm in position.

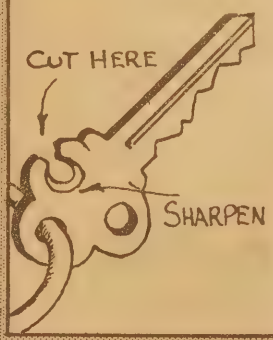
CLEANING AUGERS

Cover a piece of sash cord with glue and sprinkle with emery next time it is necessary to clean an auger drill. Pull the cord across the drill and the rust is soon removed.



STRING CUTTER

People who carry a key will find that they can have a string cutter always at hand. Modify the key by cutting away one portion and sharpening the edge of the hole as shown. It is quite safe to carry.



For the Workshop

TARZAN'S GRIP

THE UNIVERSAL FIXER

There's nothing better than Tarzan's Grip for joining and repairing model aircraft, toys, dolls, woodwork, furniture, etc. The most powerful adhesive known. Just apply to the parts—allow to set and the join is complete and permanent. Every hobby worker and householder should keep a tube in the workshop.

Instantly and permanently mends all kinds of breakages — crockery, china, kitchenware, furniture, toys, jewellery, fabrics, water piping, car parts, etc. The most powerful adhesive known. Resists moisture, acids, alkalies and extreme heat. Get a tube NOW—something may break today.

TARZAN'S GRIP

SOLD EVERYWHERE, 1/- A TUBE

LOOK FOR THE TRADE MARK

THE HAM BANDS WITH BILL MOORE

U.H.F. experimenters have been rewarded for their consistent work with the opening of 6 meters for the first interstate contacts. There have been a few experimenters, who for years have battled on the higher frequencies and at last they can see something for their endeavours.

DECEMBER 1st, at seven pm, was the turning point and VK3HK was heard by both VK2WJ and VK20C, the latter reported him 20DB above R9—some signal.

It could be seen from 10MX signals that something was on, as NSW country stations as close in as 300 miles were R9 in Sydney.

At 6.35 pm on Thursday, 5th December, VK2NO switched on his automatic sender on 6MX and within a few minutes Don was in contact with VK3MJ for the first interstate contact in amateur history—congrats.

The VK3's were audible up to 7.15 and further contacts were made by 2NO and John Peel 2WJ, the latter working four Victorian stations. 2AHF and 2AZ were also successful in contacting VK3's.

Sydney weather conditions were atrocious, a heavy thunderstorm was in progress and between static and rain interference a number of contacts were ruled out. The storm was so bad in the Blue Mountains that VK2LZ didn't venture on at all. At 7.45 2LZ first came on and heard VK4HR.

At 8.20, the VK3's came in again and VK2NO, 2WJ, 2LZ and 2AZ had further contacts. VK3's heard by 2LZ included VK3GG, 3MJ, 3HK, 3NW; 3HK putting in the most consistent signal.

2ZN reported hearing a VK7 calling a VK4 at about 8.45. The VK3's were later heard working VK4's these contacts would border on a 1000-mile range.

It was a great night and opened up a new sphere for so many, and the latest is a report that VK2NO worked VK4AW on 7th December, for the first VK2—VK4 contact.

AMATEUR RADIO IN YACHT RACE

The NZ ketch "Ilex" has left New Zealand to compete in the Sydney-Hobart race. It is the only NZ entrant, and the crew of seven includes Terry Hammond, ZL4IA, who will be ship's doctor as well as radio operator.

On the trip arrangements have been made for ZL4IA to contact amateur stations around 10 pm E.A.S.T. nightly. The ship's position will be passed and VK's are requested to forward the position to RAAF Flying Control at Rose Bay, it will then be relayed to RNZAF control at Wellington. If no message is received for 48 hours, RNZAF sea rescue service will be called into action.

There are two transmitters on board the main one running 20 watts. The antenna is a 50ft. vertical.

The Ilex will be on 40 and 80 MX, and the 80 MX frequency is 3650 kc's. The call sign ZL41A will also me used in Australian waters. One other ham will be competing, VK7LL, on the Matthew Flinders, and his call should be VK7MF.

The above information was sent over by Jack Fox of Dunedin.

Latest from this end is from Jim Corbin, VK2YC, who states that Rose Bay Civil Air Radio would appreciate any messages from the Ilex, and they can be telephoned to FU5812 or direct to VK2YC at MU1092.

CAIRO FREQUENCY ALLOCATIONS

First official news of the return to Cairo prewar band widths on 7 and 14 mc's, was received on Monday, 15th November. It was a great day for Australian Amateur Radio. Press announcements in Melbourne beat the gun, with the result that many stations were operating on the 13th and 14th. Great was the discussion thereon, and Melbourne amateurs supplying most of the news. WIA stations were active and made the first official announcement on the evening of the 15th, making full use of the wider bands, 7 mc lost its role as a noisy mass of hetrodynes to become a more normal band with a few clear spots for operation.

The Cairo allocations were as follows, 7000 to 7200 kc's exclusively amateur, 7200 to 7300 kc's shared with short wave broadcasting stations, and 14,000 to 14,400 kc's, exclusively amateur. Amateur stations in Australia have received the 14 mc band in full and 7000-7200 kc's portion of the 7 mc band. The other sector being reserved for SWBC stations.

It must be appreciated that a short wave service is essential in a country as populated as Australia and one so sparsely populated.

DX

VK2AHM, QRP King is now WAC on 10 MX, with just 4 watts—any claimants for this record?

VK5NR, 10MX expert can be heard working the more exclusive DX in the way of VO's, LX's &c. VK2D1 claims a nice one—EL2Q on 10 MX zone.

(Continued on Page 76)

A Happy New Year!

May we take this opportunity of extending to all users of N.A.P. products in every part of the Commonwealth and New Zealand, our very best wishes for 1947.

MEMO. FOR 1947—

Protective and Automatic Relays for:

- Aerial changeover 4 Pole 2 way.
- Keying
- Overload (with manual reset) to specifications.
- Power switching - high and low tension.

TIME DELAYS (Mercury Contacts)

- Positive Protection.
- Simple operation.
- Do not tire.

Actual time delay to specification.

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ALL ENQUIRIES TO DISTRIBUTORS:

MELBOURNE. Stewart J. Mathews, at 217 William St.

BRISBANE. Synchronome Electrical Co. Ltd. at 195 Elizabeth St.

SYDNEY. George J. Aitken & Co. at 247 George St. B4872.

PERTH. Carlyle & Co. at 915-917 Hay St.

ADELAIDE. Gerard & Goodman Limited, at 192-196 Rundle St.

WELLINGTON, N.Z. Giles & Elliott Ltd. at 102 Featherstone St.

SHORT WAVE NOTES BY RAY SIMPSON

LOOKING BACK ON 1946

Many New Stations For 1947

In reviewing the past year as it has affected our grand hobby of short wave listening, one of the most important phases has been the reappearance of many of the stations we knew before the war, some of them just as they always were while others could nearly be considered as newcomers.

AMONGST those which came on the air again without much change, were PCJ, "The Happy Station," Prague, Belgrade, Singapore, Manila, and one or two others, while the ex-enemy stations in Germany and Italy seem quite different from what we knew a few years ago.

Many of the European countries are now constructing new transmitters, and some of them should be ready during 1947. We can, therefore, expect to have even more crowded conditions on the bands than it is today, and as listeners know, some parts of the more popular wavebands such as the 25 and 31 metre channels are already overcrowded with stations operating on the same frequency.

Until such time as there is real co-operation between all countries as to hours of transmission, conditions will rapidly become more chaotic until worthwhile reception will be well nigh impossible.

It is no use allotting frequency channels unless all stations adhere to the particular frequency allotted, and plan their hours on the air to avoid interference. In these days of powerful transmitters, with world-wide coverage, it is only necessary for two stations to come up on the same channel to spoil reception for literally millions of listeners.

During 1947, we may expect to see some reduction in the number of transmissions by the United States, through their Armed Forces Radio Service, though as long as there are occupation forces in Japan and Europe, they will always be catered for with broadcasts from their homeland. It is possible that some of the West Coast American stations will be retained and used in a similar manner to our own Radio Australia, in conjunction with their equivalent of our Department of Information.

NIGHT RECEPTION WEAKENS

AS summer, approaches we notice a falling off in signals at night time, especially on the 49 metre band. The South Americans, who formerly were easily logged around 10.0 pm, are now very hard to find, and even if there, suffer by the high noise level.

Even on the 25 metre band, some of the Americans who used to be at maximum level around 9.0 pm, are now very patchy, and on some nights at our location, practically inaudible.

As compensation for the poor reception of stations we have become used to hearing at good strength, we note a big improvement in signals from the Africans, especially on the 25 metre band in the afternoon, when we have Brazzaville, Algiers and Dakar coming in louder than we have ever heard them in the past. This will be welcome news for many of our readers, who have not had an opportunity of checking this band lately, as African short-wave stations have never been as easy to hear as those from other continents. Strangely enough, about 10 years ago, the writer was able to log and verify two of the Capetown and one Durban station in the 31 metre band and another Durban outlet in the 25 metre band, in addition to Capetown and Johannesburg around 49 metres. As readers will note by checking the latest schedule of the South African Broadcasting Corporation, which we published in the November issue, these stations, with the exception of Durban, on the 25 metre band are still in operation, though we never receive any reports of reception, and have not logged them ourselves during the past year. Capetown, on 5883 kc, seems to be the only outlet which is now audible in this country, unless they are heard in Western Australia, from where we have had no reports for some considerable time.

READERS REPORTS

Since returning to these columns, the writer has been trying to drop a line to all readers who have been kind enough to send in reports. If you have not already received a letter, please excuse the delay, as pressure of work has not left too much time for correspondence, but hope to catch up early in the New Year.

STATIONS ADDRESSES

HERE is our latest list of addresses, as this section always seems to be of interest.

ZAA. "Radio Populicre E Shqiperise." Direccion General de la Radiodifusion d'Albanie, Rue Connference de Plaza 3, Tirana Albania.

PCJ. Philips Radio, PO Box 150, Hilversum, Holland.

YV6RD. "La Voz de Guayana," Apartado 43, Ciudad, Bolivar, Venezuela.

VUC. All India Radio, 1 Garstin Place, Calcutta, India.

XETT. Radiodifusion XETT, Uruguay No. 37, Mexico City DF, Mexico.

XETW. Radiodifusion XETW, Madero No. 10, Tampico, Mexico.

Sofia. Radio Sofia, Information Service, Sofia, Bulgaria.

Leipzig. Mitteldeutscher Rundfunk Sender Leipzig, Leipzig 22, Springerstrasse 24, Leipzig, Germany.

CXA6. Radioemissora CXA6, Mercedes 823 Montevideo, Uruguay.

CE960. "Radio La Americana," Casilla 13155, Santiago, Chile.

SHORT WAVE reports for the February issue are due by January 11. Those for the March issue are due by February 15. Send them direct to Mr. Simpson, 80 Wilga-st., Concord West, NSW.

NEW STATIONS OF THE MONTH

Call	Freq.	W.L.	Location	Time Heard
HVJ	4980kc.	60.26m.	Vatican City	4.15 am.
Radio Ruhr	6010kc.	49.92m.	Germany	4.00 pm.
HC4FM	6875kc.	43.64m.	Manta, Equador	4.00 pm.
HVJ	7235kc.	41.46m.	Vatican City	1.00 am.
WCBX	9490kc.	31.61m.	New York, N.Y.	6.00 am
CR7BJ	9650kc.	31.09m	Mozambique.	6.00 am
Radio Algerie	11835kc.	25.35m.	Algiers, Algeria	4.30 pm.

FLASHES FROM EVERYWHERE

PITCAIRN ISLAND.—This island is seldom heard from except from the amateur station VR6AY, which used to be heard consistently, and incidentally gave the writer his 100th country verified back in 1938. There is now another station in operation on this island, ZKG, which uses this call for 8290, 12450 kc, ZKG3 8635 kc, ZKG4 12110 kc, ZKG5 7270 kc. The transmitter in use has a power of 1 kw, and the station is only used for the transmissions of weather reports, and does not handle any other kind of traffic. This one should make a good catch, and readers will be interested to know that it verifies. The above item was gleaned from the Universalite.

SS LURLINE.—Readers who have long ago given up all hope of receiving their verifications from slow answering stations, should take a lesson from the following. We have just received our verification confirming our reception of KIEK, our report on which was sent out on 23rd November, 1941, so we had to wait for five years and three days for our reply, and readers can imagine how pleased we were to receive it. The remarkable thing about it was when the reply did come, it was sent by Clipper Air Mail from San Francisco in a rather belated effort to make up for lost time. Incidentally, this transmitter has now been removed from the Lurline.

TAHITI.—A station which we have always been particularly interested in, but which we have never succeeded in logging, is FO8AA, "Radio Club of Oceania," located in Papeete, and which operates on 6980 kc. The latest schedule of this one is 1.0 pm to 3.0 pm on Wednesdays and Saturdays, only giving recordings until 1.30 pm, news and talks in French until 2.30 pm, and then Tahitian programme until closing at 3.0 pm. This one can often be heard by our New Zealand listeners, but we have yet to hear of any Australian listener who has definitely heard them and received their verification. The writer has tried for years, but so far without success.

VATICAN CITY.—We have had quite a few requests for information as to when these stations can now be heard. The only outlet we have personally logged lately is the one on 6190 kc, which seems to be on irregularly in the mornings at 5.30 when it is at very good strength. American sources give the schedule as 15120 kc, midnight till 12.20 am daily, and on the same frequency on Tuesdays, only from 4.3 pm till 4.35 pm. HVJ is also listed as being heard on 17445 kc, Wednesdays only, from 1.15 am till 1.40 am. The programme on 15120 kc, from midnight, is given in English, so no difficulty should be had in identification. They also use "Laudeteur Jesus Christus," quite frequently on opening.

CEYLON.—The Forces Broadcasting Service, who conduct Radio SEAC in Colombo, are now sending out a verification card instead of the usual letter. We have just received our card verifying our reception of the new outlet on 7185 kc, which we reported in last month's issue. The card was endorsed to the effect that ours was their first report from Australia for this frequency (this makes our total "firsts" 78). They state that this transmitter is the same as that normally used on 6075 kc and is 7.5 kw. Card is a large white one with black lettering and a large crest. They say "Further reports and suggestions are welcome, please send them to: Radio SEAC, c/o. GPO, Colombo, Ceylon.

HUNGARY.—We are indebted to "Radio News" for the following item concerning short-wave broadcasts from Hungary. In a letter from the Section of Foreign Relations of the Hungarian Radio, Budapest, they write as follows: "Unfortunately due to the destruction caused by the Nazis, we are unable to transmit on short waves for the time being. The new, democratic Hungarian Radio makes great efforts in the work of reconstruction, and we hope that our short-wave station will be in operation before long. All depends on surmounting the technical difficulties, and the great shortage of raw material." It looks, therefore, that it will be some time until we once again can tune in to what used to be an easily-heard European.

BEST BETS OF THE MONTH—TIME SCHEDULE

This chart for quick reference gives the call, frequency and listening times for the best stations on the air. Where the station is not at good strength when it opens transmission, the time is given at which reception, under normal conditions, should be satisfactory.

6.0 am to Noon.

VLR2 6150kc. Lyndhurst. Good steady signal at 7.0 am.

WNRX 9750kc. New York. Very good at 6.30 am.

CHOL 11720kc. Montreal. Really good now around 7.0 am.

VLH5 15240kc. National programme at good strength from 8.30 am.

HOXA 15100kc. Panama City. Good with programme in English 7.0 am.

KNBA 17780kc. Dixon. Excellent during the forenoon.

KRHO 17800kc. Honolulu. Another good station around 11.0 am.

Noon to 6.0 pm.

FZI 11970kc. Brazzaville. Very good around 3.0 pm.

VLB3 11770kc. Shepparton. Excellent in afternoon at 5.0 pm.

GSN 11820kc. London. Always a good station in afternoon.

GRX 9690kc. London. Excellent daily around 5.0 pm.

VUD10 17830kc. Delhi. Listen for the news at 1.30 pm.

VLG3 11710kc. Lyndhurst. Excellent in French programmes at 4.30 pm.

HER5 11865kc. Schwarzenbourg. Very good Tuesdays and Saturdays 4.0 p.m.

KNBX 15250kc. Dixon. Very good on most afternoons.

GSB 9510kc. London. Excellent at 5.30 pm.

6.0 pm to Midnight.

VLR2 6150kc. Shepparton. Excellent station until midnight.

GSV 17810kc. London. Usually good around 10.0 pm.

KCBR 9700kc. Delano. Nice signal from 8.0 pm.

KRHO 9650kc. Honolulu. Another good 31 metre band station.

Saigon 11780kc. Always a good station at 9.0 pm.

Singapore 15275kc. Improved since last month at 7.0 pm.

Algiers. 11835kc. Excellent station opening at 4.30 pm.

Bandoeng. 11000kc. Very good recordings around 9.0 pm.

XEWW 9500kc. Mexico City. Excellent station at midnight.

B.B.C. Broadcasting Schedules

BBC SCHEDULES

AS mentioned in the November issue, we intended to list the BBC stations in every third issue, instead of monthly as formerly. To conform with this new policy, they should have been listed this month, but unforunately the BBC did not send us the information asked for, but only their Short Waveband Chart, which does not list the individual stations, but only the bands in use at various times.

However, as these stations are receiving at such good level on most occasions, we feel this should be sufficient for readers to find at least one station at entertainment level.

We are therefore listing below the various services which are now in operation, and times on the air.

GENERAL OVERSEAS SERVICE

THIS is a 24-hour service, and now incorporates the General Forces programme for all serving men and women in Overseas Commands. Programme features:

1. News at 11 am, 12.30, 2, 4, 5, 6, 9, 11 pm, 2, 3, 6, 8.45 am.
2. British Press Review at 12.35 pm and 2.10 am.
3. Radio newsreel at 2.15 pm, 11.15 pm Sat. only, 1.0 am, 7.10 am.
4. London Calling (Programme Announcement and Summaries). 12.40, 2.10, 11.5 pm, 1.15 am, 8.55 am.

Wavebands in use for Australia and NZ.

Morning, 25, 31; afternoon, 19, 25 31; evening, 13, 16, 19, 25, 31.

PACIFIC SERVICE

Directed to Australia, New Zealand, Australasian Waters. On the air from 4.0 pm to 8.0 pm.

Programme Highlights:

4.0 pm to 4.10 pm The News.

4.10 pm to 4.15 pm, London Calling (Programme Announcements).

4.30 pm to 4.45 pm, Radio Newsreel.

5.45 pm to 6.0 pm, "The Robinson Family" (except Sat. and Sun.).

6.0 pm to 6.5 pm, The News.

6.25 pm to 6.30 pm, "From Today's London Papers."

7.45 pm to 7.50 pm, "London Calling" (Programme Announcements).

7.53 pm to 7.58 pm, The Daily Service (except Sundays).

Wavebands in use for Australia and NZ: Morning, 25, 31; afternoon, 19, 25 31; evening, 13, 16, 19, 25, 31.

AFRICAN SERVICE

Directed to South, Central, East and West Africa, Near East, Mediterranean Area, and Atlantic Ocean, and on the air from 1.30 am to 7.0 am Daily.

Wavebands in use for Near East: Morning, 16, 25, 41; afternoon, 13, 16 19; evening, 31, 41.

NORTH AMERICAN SERVICE

Directed to USA, Canada, Central and South America, West Indies, SW, Central and North Atlantic, 7.15 am to 12.45 pm.

Programme Highlights:

7.15 am to 7.30 am "London Calling" (Programme Summary).

7.45 am to 7.50 am, The News.

8.30 am to 8.45 am, The Robinson Family.

8.45 am to 8.55 am, The News.

9.45 am to 9.55 am, The News.

10.15 am to 10.30 am, "London Calling."

10.30 am to 10.45 am, Radio Newsreel.

10.45 am to 11.0 am, Topical Talks.

11.0 am to 11.10 am, The News.

12.30 pm to 12.35 pm, The News.

12.35 pm to 12.40 pm, Survey of British Press.

Wavebands in use for USA: Morning, 13, 16, 19, 31; afternoon, 19, 25, 31, 49; evening, 31, 49.

If readers consider the above to be sufficient to enable them to tune in these stations, we will publish it again in three months, or alternatively give the complete listing by stations which can be heard here. We will adopt whatever method the majority of listeners prefer so please indicate your choice early in the new year, so that we can make all necessary arrangements to obtain all the information required to meet the situation.

READERS' REPORTS

REPORTS from readers are always welcome, and this month we have to thank the following for some very interesting letters:—Mr. C. Reid, Smithton, Tas.; Miss D. Sanderson, Malvern, Vic.; Mr. J. Paris, Prospect, SA; Mr. R. Gillett Dudley Park, SA; Mr. M. Krumbeck, Kogarah, NSW; Mr. G. D. Gilbert, Burwood, NSW; Mr. Art. Cushen, Invercargill, NZ; Mr. G. D. Hutchens, Melbourne, Vic.; Mr. J. F. Fox, Dunedin, NZ; Mr. A. Lee, Merewether, NSW.

There are still many readers who used to contribute to these pages before the war whom we have not heard from since once again taking up the compiling of the short wave notes.

We would especially like to hear from any of these old friends and extend a hearty invitation to once again give us the benefit of their loggings for the benefit of all our readers.

THIS MONTH'S VERIFICATIONS

THE following readers have received cards or letters confirming their reports:—

Miss D. Sanderson. Radio Andorra.

Mr. R. Gillett. Radio Italiana, Radio Algerie, Radio Andorra, Radio Tirana, TGWA, XORA, XEBR, PMD, PLY, NICO LRX, CFRX, CR7BU, HS8PD, WVTV, Radio Polskie, Brussels.

Mr. G. D. Gilbert. COCQ, Singapore.

Mr. A. Cushen. Radio Sofia (7660 kc), Radio Rodina (9315 kc), KOFA (7220 kc), XTPA.

Mr. J. F. Fox. HJAG, HER4.

Our Own Listening Post. SEAC (7185 kc, 1st report from Australia), KIEK (8820 kc, SS Lurline), VLB5 (21540 kc, 21600 kc), HER4 (9535 kc), FZI (9440 kc, 9980 kc), VUD3 (11850 kc, 15130 kc).

FIRE AT KZRH

ACTUALITY BROADCAST

QUITE an interesting broadcast was heard from the Manila station KZRH one night recently when they described a fire which broke out in the Insular Life Building, two floors below the studios of this station. At the height of the fire, which at one period threatened to engulf the entire building, the announcer became very excited and gave a very descriptive account of the efforts made by the City Fire Department to quell the outbreak.

In addition to the city's civilian fire brigade, detachments from the military fire fighting units were also in attendance and it appeared as if some sort of rivalry was in evidence as to who was doing the best job of putting out the fire.

The actuality boadcast was made from the building next door, evidently from an insurance office as the running commentary was interspersed with frequent injunctions to local residents to ensure that they were well covered in the matter of fire insurance to prevent them suffering the same fate as the unfortunate tenants of the Insular Life Building. The benefits of insurance were plugged from all angles together with frequent warnings to children on the dangers of playing with matches, &c. No doubt the insurance company were real live wires and when they found that KZRH wished to use their building as a vantage point to describe the fire, made a bargain with them for some free advertising. After the description of the fire, the normal programme was resumed from the studios with the performers possibly keeping an eye on the fire escape in case they had to beat a hasty retreat.

Altogether it was one of the most entertaining broadcasts heard for some time and with a decided humorous slant. It would be interesting to know if the station itself was covered by the same insurance they were trying to sell to some listeners.

V.H.F. CORNER

So far we have had no reports of any of the higher frequencies from 40 to 50 mc., so have been unable to publish anything in this regard as originally intended and mentioned in these columns in the September issue. We had hoped to have had our own converter working on this band before this but, unfortunately, have not as yet been able to finish it We hope to rectify this over the Christmas holidays and perhaps by the time the next issue goes to press we may have something interesting to report. If anyone else is having any success around these channels, be sure to let us know so that we can pass it on to all other listeners.

OVERSEAS S.W. STATIONS NOW AUDIBLE

The following stations have actually been heard in this country during the past month and the majority should be audible on a sensitive receiver. All times are Australian Eastern Standard Time.

NORTH AMERICA

13 METRE BAND

WLWL—21650kc. 13.86m. Cincinnati, Ohio. Comes in nicely in South American programme around 9.30 am.

WLWS—21650kc. 13.86m. Same location. European programme is radiated from this outlet around 11.0 pm.

WCRC—21570kc. 13.91m. New York. This station carries the same programme as WLWS.

WNRX—21610kc. 13.88m. Same location. The best on the band with the same programmes as above.

KNBA/I—21610kc. 13.88m. Dixon, Cal. Still being heard opening at good strength in mornings at 7.0 am.

16 METRE BAND

WRUW—17750kc. 16.90m. Boston, Mass. Audible at midnight at some locations but very weak at our post.

WNBI—17780kc. 16.87m. New York. Best in the mornings at 8 am but also heard around 11 pm.

WCRC—17830kc. 16.83m. Same location. Another station which is heard at the same times as the above.

WLWL—17955kc. 16.71m. Cincinnati, Ohio. Carries the European programme at night.

KRHO—17800kc. 16.85m. Honolulu, Hawaii. Herald Tribune Forum can be heard at 10.45 am.

KCBF— 17850kc. 16.81m. Delano, Cal. Quite a loud station in the mornings at 10 am.

KNBA/I—17770kc. 16.88m. Dixon, Cal. Hit Parade programme heard in forenoons at 10.30 am.

KWIX—17770kc. 16.88m. San Francisco, Cal. Good in the late afternoons with music and news.

19 METRE BAND

WGEA/O—15330kc. 19.57m. Schenectady, NY. The United Nations Review can be heard at 8.30 pm.

WBOS—15210kc. 19.72m. Boston, Mass. Heard in the forenoon at 10.15 am and also at night around 10.30 pm.

WNRE—15280kc. 19.63m. New York. The European programme can be heard at 7.30 am and also at night at 11.30 pm.

WCBN—15270kc. 19.65m. Same location. Quite a good station at night around midnight.

WNBI—15150kc. 19.81m. Same location. The Latin-American session can be heard in the early afternoon.

WOOC—15200kc. 19.74m. Same location. This C.B.S. station is heard around 7 am and also late at night.

WRUL—15290kc. 19.62m. Boston, Mass. Good station every morning till closing at 7.45 am.

WRUA/S—15130kc. 19.83m. Same location. Another of the World Wide Broadcasting stations heard well till 7 am.

WRUS—15350kc. 19.54m. Same location. Comes on the air at midnight with programme in German.

WLWO—15350kc. 19.54m. Cincinnati, Ohio. Nice signal in the mornings till 7.30 am.

WLWR—15250kc. 19.67m. Another of the Crosley stations which is easily heard till closing at 7.30 am.

WRCA—15150kc. 19.81m. New York. Fair strength when it opens at midnight.

KCBA—15240kc. 19.69m. Delano, Cal. This is quite a good one in forenoons when used in parallel with KCBF on 17850kc.

KGEX—15210kc. 19.72m. Belmont, Cal. Very good station from noon until later in the afternoon.

25 METRE BAND.

WNBI—11893kc. 25.22m. New York Opens in the mornings at 6.30 am and closes again at 7.30 am.

WCRC—11830kc. 25.36m. Same location. Quite a nice signal in the mornings at 6.30 am.

WLWS—11710kc. 25.62m. Cincinnati, Ohio. News and music from this Crosley station at 6.30 am.

WNRA—11790kc. 25.45m. New York. Always a nice signal from this NBC station at 7 am.

WLWO—11710kc. 25.62m. Cincinnati, Ohio. Music at Ease session directed to Europe nightly at 10.15 pm.

WRUL—11730kc. 25.57m. Boston, Mass. Reasonably good strength in the afternoons till 3 pm.

WOOW—11810kc. 25.40m. New York. Rather weak but is audible nightly at 9.45 pm.

WOOC—11870kc. 25.27m. Same location. Another of the CBS stations which is excellent at 7 am.

31 METRE BAND.

WGEO—9530kc. 31.48m. Schenectady, NY. Latin American session heard in forenoon at fair strength.

WCBX—9490kc. 31.61m. New York. Cross Section and America Speaks comes in well from this CBS station at 7 am.

WLWK—9590kc. 31.28m. Cincinnati, Ohio. Programme in French can be heard in the forenoon from this Crosley station.

WNRX—9750kc. 30.77m. New York. Very good signal before breakfast in the programme for Europe.

KRHO—9650kc. 31.09m. Honolulu, Hawaii. Excellent every night at most locations.

KCBR—9700kc. 30.92m. Delano, Cal. Reaches very good level every night now and can be heard till quite late.

KCBA/F—9750kc. 30.77m. Same location. The same remarks apply to this California station.

KNBA/I—9490kc. 31.61m. Dixon, Cal. Always a strong signal in the programme directed to the Orient.

49 METRE BAND.

WRUA/S—6040kc. 49.67m. Boston, Mass. These stations have not improved in strength since last month and are still weak 3 pm.

BETWEEN BAND STATIONS.

WNRI—13050kc. 22.99m. New York. This outlet is used for the European programme and is heard well at 11 pm.

WNRX—14560kc. 20.60m. Same location. Have logged this NBC outlet at 5 am.

SOUTH AMERICA

LRS—9320kc. 32.19b. Buenos Aires, Argentina. This Argentine station can still be logged on a Sunday till closing at 2 pm.

LRY—9450kc. 31.75m. Same location. This is the only other Argentine station heard at our location now and logged at 7 am.

PRL8—11720kc. 25.6m. Rio de Janiero, Brazil. This station seems to give a special programme about once a month opening at 8 pm.

CE1174—11740kc. 25.55m. Santiago, Chile. Often heard at surprising strength at night from around 9 pm but all in Spanish.

CE1180—11990kc. 25.21m. Valdivia, Chile. This is always the loudest of the Chilean stations and always audible about 9.30 pm.

CE1185—11850kc. 25.32m. Santiago, Chile. Have only heard this one in the forenoon on two occasions when it was weak at 10 am.

CE1190—11900kc. 25.21m. Valdavia, Chile. This one is weak but if you listen for it after the American closes at 9.30 pm, it can be heard.

OAX4Q—6010kc. 49.92m. Lima, Peru. Noisy now on a Sunday afternoon but often heard announcing as Radio Victoria around 4.30 pm.

OAX4W—9375kc. 32.00m. Same location. Another South American which is still audible on a Sunday afternoon till closing at 2.45 pm.

OAX4J—9340kc. 32.12m. Same location. This is another Sunday afternoon station which is heard closing at 3 pm.

OAX4— —9535kc. 31.47m. Huacho, Peru. New one, "Radio Central," heard in NZ by Art Cushen and closing Sundays at 3 pm.

CXA19—11835kc 25.35m. Montevideo, Uruguay. This is the only one heard from this country and logged most mornings at 7 am.

HCJB—9958kc. 30.43m. Quito, Ecuador. Comes in nicely at night around 10 pm and easily identified as English used.

HCJB—12455kc. 24.09m. Same location. Heard in the early morning at 6.30 am and also at night around 9.30 pm.

HCJB—15095kc. 19.87m. Same location. Missionary type programme can be heard nightly from this one around 10 pm.

HCQRX—5970kc. 50.25m. Same location. Weak on opening at 9.45 pm but identified by its use of the CBS announcements.

HC4FM—6875kc. 43.64m. Manta, Ecuador. Another new one heard in NZ by Art Cushen when it closes on a Sunday afternoon at 4 pm.

HJCAB—9690kc. 30.96m. Bogota, Colombia. Rather weak now but has been logged on a Sunday with news in Spanish just after 2 pm.

HJCX—6018kc. 49.84m. Same location. Would be hard to identify now opening at 10 pm or a few minutes earlier on some nights.

YV5RM—4970kc. 60.38m. Caracas, Venezuela. This is the only one heard from this country and very noisy at 9 pm.

PRL7—9720kc. 30.86m. Rio de Janeiro, Brazil. Only reported by Miss Sanderson from Victoria who hears it at 6.45 am.

CENTRAL AMERICA AND WEST INDIES

HP5A—11695kc. 25.65m. Panama City, Panama. Often heard recently around 10.0 pm.

HP5B—6030kc. 49.75m. Same location. Noise level once again spoils this one at 10.0 pm.

HP5J—9607kc. 31.23m. Same location. Reaches good strength on some nights by 10.30 pm.

HP5H—6122kc. 49.00m. Same location. Only very weak even on a good night, but heard one Saturday closing at 3.30 pm.

HOXA—15100kc. 19.87m. Same location. Really good in the mornings with music and English announcements by Jim Ward at 7.0 am.

HOXB—11810kc. 25.40m. Same location. Heard using this frequency on afternoon till nearly 5.0 pm. in test line up.

TGWA—15170kc. 19.78m. Guatemala City, Guatemala. Have heard it on a Monday morning till around 7.0 am.

TGWA—9760kc. 30.74m. Same location. Only heard on two occasions closing at 4.0 pm.

TIPG—9618kc. 31.19m. San Jose, Costa Rica. Very erratic of late and quite often inaudible at 10.30 pm.

HH3W—10135kc. 29.6m. Port-au-Prince, Haiti. Good musical numbers nightly around 10.30 pm.

COKG—8920kc. 33.50m. Havana, Cuba. Fair strength at some places at 9.45 pm.

COCX—9270kc. 32.36m. Same location. One of the most consistent of the Cubans and can usually be heard at 11.0 pm.

COCQ—8825kc. 33.99m. Same location. Another Cuban which has now been heard for a number of years and usually good at 10.0 pm.

COHI—6455kc. 46.48m. Santa Clara, Cuba. Smothered under morse, but can be identified by its position on the dial.

COBC—9362kc. 32.04m. Havana, Cuba. One of the morning Cubans and heard best at about 8.0 am.

HRPI—6350kc. 47.26m San Pedro Sula, Honduras. Not heard in this country, but audible in NZ until closing at 3.30 pm.

CANADA

CHOL—11720kc. 25.60m. Montreal. One of the best on the band in the mornings at 7 am and easily followed.

CKRA—11760kc. 25.51m. Same location. Have only heard this one on a Sunday in the forenoon.

CKNC—17820kc. 16.84m. Same location. Very weak at our location but heard occasionally closing at 6 am.

CKLX—15090kc. 19.88m. Same location. Have only heard this one once right behind the strong telephone carrier.

CFRX—6070kc. 49.42m. Toronto, Ont. Rather better than last month and still audible at midnight.

CBRX—6160kc. 48.70m. Vancouver, BC. The morning Church service was easily logged at 1.45 am from this one.

MEXICO

XEWW—9500kc. 31.58m. Mexico City. Excellent signal from this old-timer at 1 am. Also heard in the afternoon.

XEQQ—9680kc. 30.99m. Same location. This Mexican was also heard at 1 am but not nearly as loud as XEWW.

XEBT—9625kc. 31.17m. Same location. A

good Sunday afternoon station and heard best at about 3 pm.

XERQ—9615kc. 31.21m. Same location. Occasionally this one breaks through the interference just after 10 pm.

XEYU—9600kc. 31.25m. Same location. Miss Sanderson hears this Mexican at good strength in the mornings at 7 am.

EUROPE

Athens—7290kc. 41.15m: Greece. Again being heard with news in English at 6.15 am.

Madrid—9370kc. 32.00m. Spain. Quite a good signal in the early morning and English often heard.

EDV10—7100kc. 42.25m. Madrid, Spain. "Radio SEU" has again been logged at good strength just before 7 am.

EAJ3—7035kc. 42.64m. Valencia, Spain. Another good Spanish station around 6.30 am.

EAJ9—7020kc. 42.74m. Malaga, Spain. Not as loud as the others on this band, but always audible at 6.30 am.

Radio Andorra—5980kc. 50.02m. Not as loud as a few weeks ago but the "Music for You" session is heard at 6.30 am.

Milan—11810kc. 25.40m. Italy. Not very good at our location though heard with music and news in Italian around 7 am.

SDB2—10780kc. 27.83m. Motala, Sweden. News in German and music heard at 7.15 am.

SBP—11705kc. 25.63m. Same location. This one is best on a Sunday afternoon and can be heard till as late at 8 pm.

SBT—15155kc. 19.80m. Same location. This one is used at the same time as SBP.

SBU—9535kc. 31.47m. Same location. Have heard this one is the early morning at 5 am.

OLR4A—11840kc. 25.34m. Prague, Czechoslovakia. The only one from this country heard and comes in best at about 6 am.

PHI—6023kc. 49.82m. Hilversum, Holland. Can be heard every morning in good musical programme.

PCJ—9590kc. 31.28m. Same location. Good signal on the right morning about 6.30 am.

PCJ—11730kc. 25.58m. Same location. This Dutch station is good with news and music around 6.30 am.

PCJ—15220kc. 19.71m. Same location. Quite often heard opening at 11 pm but not actually scheduled for that time.

PCJ—17770kc. 16.88m. Same location. Heard more consistently at 11 pm with news in English, Dutch, and music.

CSW6—11040kc. 27.17m. Lisbon, Portugal. Very good musical items between 6 am and 7 am.

CSX—6370kc. 47.10m. Same location. Very hard to hear at our location now due to high noise level around 6.30 am.

CS2WI—12400kc. 24.19m. Parede, Portugal. Interfered with by Morse which makes reception poor at 6.30 am.

OIX2—9503kc. 31.57m. Lahti, Finland. Rather patchy of late but audible around 6 am.

OIX4—15190kc. 19.75m. Same location. Has again been heard on Sunday afternoon from before 5 pm.

Belgrade—9420kc. 31.85m. Yugoslavia. Comes in reasonably well in the mornings and also in the late afternoons.

TAP—9465kc. 31.70m. Ankara, Turkey. Excellent station in the mornings about 6 am.

HER3—6165kc. 48.66m. Schwarzenbourg, Switzerland. Still good signal in mornings at 6.30 am.

HER4—9535kc. 31.47m. Same location. Hard to separate from others but heard with German programme at 6 am.

HE14—9539kc. 31.45m. Same location. Another morning station which seems to be sometimes used instead of HER4.

HED4—10405kc. 28.83m. Same location. The programme for North America comes in well around 5.30 am.

HE15—11715kc. 25.61m. Same location. Heard some days at 7 am and also at 6 pm in English.

HER5—11865kc. 25.28m. Same location. Comes in well most mornings at 7 am, English being heard.

HEK4—11960kc. 25.08m. Same location. The Spanish programme at 8 am is now very hard to hear.

HEK3—7380kc. 40.65m. Same location. At 6.30 am news in German and music can be heard at good strength.

HBZ2—14538kc. 20.64m. Same location. Tuesdays and Saturdays are best for this one at 4 pm.

HER6—15305kc. 19.60m. Same location. Opens up at 1 am when strength is only fair.

HE17—15320kc. 19.58m. Same location. An all-English programme can be heard here opening at 5.20 am.

HER7—17784kc. 16.87m. Same location. A Monday night station and heard at 6 pm in programme directed to Japan.

HBF—18450kc. 16.26m. Prangins, Switzerland. This one opens at 1 am in programme for the Orient.

HBJ—12965kc. 23.14m. Same location. This is a new one and is on the air on Tuesdays at 6 pm.

Luxembourg—6090kc. 49.26m. Rather poor now in the mornings as the noise level is much higher.

LKJ—6130kc. 48.94m. Oslo, Norway. Another station which is now rather hard to log in the mornings.

LLJ—6200kc. 48.39m. Kloefta, Norway. This other Norwegian is not even as good as the one on 6130kc.

Berlin—9730kc. 30.83m. Germany. Heard in the mornings at 7 am and also in the afternoons at 4 pm.

Berlin—6070kc. 49.42m. This German can be heard in the mornings at 6 am but is very weak.

Leipzig—9730kc. 30.83m. Shares this frequency with Berlin and it is hard to tell which is which.

AFN—6080kc. 49.34m. Munich, Germany. Another station which suffers from the high noise level in the mornings.

Warsaw—6114kc. 49.06m. Poland. The news in English can just be heard at 6.30 am.

Brussels—17840kc. 16.82m. Belgium. Has now been logged on a few afternoons around 4 pm and also occasionally at 10.30 pm.

Azores—11090kc. 27.05m. One of the loudest morning stations with good musical numbers until closing at 7 am.

Radio Ruhr—6010kc. 49.92m. Germany. New one heard by Art Cushen at 4 pm.

AUSTRALIA AND OCEANIA

VLA4—11770kc. 25.49m. Shepparton. 6.30 am to 9.30 am to British Isles, 2.45 pm to 3.45 pm to North America, 5.0 pm to 6.15 pm, Saturdays only, to British Isles, 2.0 am to 3.0 am to N. America.

VLA6—15200kc. 19.74m. 6.45 pm to 9.30 pm to Pacific.

VLA8—11760kc. 25.51m. 1 am to 2 am to British Isles, 10 pm to 1 am to Pacific.

VLA9—21600kc. 13.89m. 5 pm to 6.15 pm to British Isles (except Saturdays, 10.15 am to 11.30 am) to N. America, noon to 2 pm to Forces in Pacific.

VLB—9540kc. 31.45m. Shepparton. 11 pm to 12.15 am to N. America.

VLB2—9630kc. 30.99m. 2.45 pm to 3.45 pm to N. America.

VLB3—11770kc. 25.49m. 5 pm to 6.15 pm to British Isles (except Saturdays).

VLB5—21540kc. 13.94m. Noon to 2 pm (Saturdays till 5.29 pm) to Forces in Pacific.

VLB6—15200kc. 19.74m. 7.15 am to 9.30 am to Forces in Pacific.

VLB8—21600kc. 13.89m. 6.30 pm to 10.30 pm to Forces in Pacific.

VLB9—9615kc. 31.20m. 1 am to 2 am to British Isles.

VLC4—15320kc. 19.58m. Shepparton. 1 am to 1.45 am to British Isles, 2.45 pm to 3.45 pm to N. America, 4 pm to 4.45 pm to Tahiti, 5.30 pm to 6.45 pm to New Caledonia (Saturdays excepted, 6.55 pm to 10.45 pm to Pacific, 12.30 am to 1 am to India.

VLC6—9615kc. 31.20m. 2 am to 3 am to N. America.

VLC7—11840kc. 25.53m. 11 pm to 12.15 am to N. America.

VLC9—17840kc. 16.82m. Noon to 2 pm to Pacific Forces.

VLC10—21680kc. 13.84m. 5 pm to 6.15 pm to British Isles on Saturdays only, 7.15 am to 9.30 am to Pacific Forces.

VLG3—11710kc. 25.62m. Lyndhurst. 4 pm to 4.45 pm to Tahiti, 5.30 pm to 6.45 pm to New Caledonia.

VLG5—11880kc. 25.25m. Noon to 2 pm to Pacific Forces.

VLG7—15160kc. 19.79m. National programme week days 6 am to 8 am, Sundays 6.45 am to 8.15 am.

VLG9—11900kc. 25.21m. 10 pm to 1 am to Pacific.

VLG10—11760kc. 25.51m. 2 am to 3 am to South Africa.

VLH3—9580kc. 31.32m. National programme week days and Sundays 6.15 pm to midnight.

VLH4—11880kc. 25.25m. National programme week days 6 am to 8 am, Sundays 6.45 am to 8.15 am.

VLH5—15240kc. 19.69m. National programme week days and Sundays 8.30 am to 6 pm.

VLR—9540kc. 31.45m. National programme week days and Sundays 9.15 am to 6.15 pm.

VLR2—6150kc. 48.78m. National programme week days 6 am to 9 am, 6.28 pm to midnight, Sundays 6.45 am to 9 am, 6.28 pm to midnight.

VLQ—7240kc. 41.44m. Brisbane. National programme week days 6 am to 10 am, Sundays 6.45 am to 10.30 am.

VLQ2—7215kc. 41.58m. National programme week days and Sundays 6.28 pm to midnight.

VLQ3—9660kc. 31.06m. National programme week days 10.15 am to 6.15 pm, Sundays 10:50 am to 6.15 pm.

VLW3—11830kc. 25.36m. Perth. National programme week days and Sundays 10.30 am to 6 pm.

VLW7—9520kc. 31.51m. Week days 6 am to 10.15 am and 6.15 pm to midnight, Sundays 6.45 am to 10.15 am and 6.15 pm to midnight.

ZLT7—6715kc. 44.68m. Wellington, New Zealand. News session is given nightly at 7.30 pm.

Noumea—6208kc. 48.34m. New Caledonia. Cannot hear it at our location but reported by some readers as audible at 6 pm.

Radio Rodina—9340kc. 32.12m. Sofia, Bulgaria. Can be logged daily with news in English at 6.30 am. Closes at 6.40 am.

Moscow—17820kc. 16.84m. USSR. Music and news every night about 7.30 pm.

Moscow—15340kc. 19.56m. Talks in English can be heard nightly at 10.30 pm.

Moscow—15440kc. 19.43m. Another Russian which gives English session at 7.30 pm.

Moscow—11630kc. 25.80m. This outlet is also heard nightly in English at 10.30 pm.

Moscow—9565kc. 31.37m. Musical programme is found on this frequency every night from around 8 pm.

Paris—9520kc. 31.51m. France. A good morning station on the 31-metre band.

Paris—9620kc. 31.19m. Another French station which is audible every morning at 6.30 am.

Paris—9560kc. 31.38m. Usually a very loud station in the mornings at 6 am.

Paris—11845kc. 25.33m. This one can be logged every morning at 7 am in native-type programme.

Paris—11885kc. 25.24m. Have logged this station around 4 am but is heterodyned by some other one.

Paris—15240kc. 19.69m. Quite a nice signal at some locations with news and music around 10 pm.

Paris—17765kc. 16.88m. Also heard well from around 11 pm.

HVJ—15095kc. 19.87m. Vatican City. Very good strength from this one at 1 am with news in English.

HVJ—7235kc. 41.46m. Same location. This is the new one reported and heard at quite good level at the same time as one on 15095kc.

HVJ—9660kc. 31.06m. Same location. English session heard from this outlet at 4.15 am at fair strength.

HVJ—4980kc. 60.26m. Same location. Used in parallel with the one on 9660kc. but very noisy at our location.

Paris—17850kc. 16.81m. Quite a nice signal from this one with programme in Spanish till closing at 1.30 am.

AFRICA

Radio Somali—7125kc. 42.10m. Hargeisa, British Somaliland. Only reported infrequently now as heard around 1 am.

Tananarive—6065kc. 49.46m. Madagascar. Have now heard this one at good strength in the mornings at 4 am.

Tananarive—6140kc. 48.66m. Same location. Heard in parallel with the 6065kc. outlet but not as good at our location.

Algiers—6040kc. 49.66m. Algeria. Except for the noise on the band, this African can be heard well around 6.30 am.

Algiers—9540kc. 31.45m. Same location. Always audible in the mornings at 7 am and earlier.

Algiers—9610kc. 31.22m. Same location. At some locations is heard well until closing down at 8.15 am.

VQ7LO—4950kc. 60.16m. Nairobi, Kenya Colony. This station can always be heard in the mornings around 4 am.

CR7BF—4925kc. 60.91m. Lourenco Marques, Mozambique. Think this outlet may be off now as only heard early in month.

CR7AA—5863kc. 51.10m. Same location. Come in very well in the early hours about 3.30 am and later.

CR7BJ—9650kc. 31.09m. Same location. This is the new one used in place of CR7BE and heard quite well at 6 am.

CR7BD—15240kc. 19.69m. Same location. An afternoon station and occasionally heard in English closing at 4 pm.

CNR3—9080kc. 33.04m. Rabata, French Morocco. More consistent now and reported as audible in afternoons from just after 4 pm.

CNR—16680kc. 17.99m. Same location. Have heard this one at the unusual time of 9.30 pm but not very loud.

OTM3—9370kc. 31.98m. Leopoldville, Belgian Congo. Can be heard every morning around 6 am. Notice change in call letters.

OTC1—17770kc. 16.88m. Same location. Another changed call and has been heard on a few occasions around 11 pm.

FGA—11715kc. 25.61m. Dakar, Senegal. Has still been heard in the afternoons at 5 pm at excellent strength.

FZI—6024kc. 49.80m. Brazzaville, French Equatorial Africa. Can be logged every morning around 6.30 am.

FZI—9440kc. 31.78m. Same location. Can always be heard in the mornings at 7 am.

FZI—9980kc. 30.06m. Same location. Another of the same stations and comes in well in the mornings at our location.

FZI—11970kc. 25.05m. Same location. This one is very good indeed at 7 am and also at good strength in the late afternoons.

ZNB—5900kc. 50.85m. Mafeking, British Bechuanaland. Has again been reported as heard around 3.30 am.

SUV—10050kc. 29.84m. Cairo, Egypt. Can be heard between 3 am and 4 am and asking for reports on transmission.

Radio Algerie—11835kc. 25.35m. Algiers, Algeria. This is the new one heard opening at 4.30 pm. Possibly has been already heard by some listeners when operating previously.

OFF THE RECORD — NEWS & REVIEWS

A set of records which is bound to raise an age-old question is to be found in this month's lists. It is a selection of abbreviated movements from various classical works, all of them piano concertos.

"THE HEART OF THE PIANO CONCERTO"

Bach: Concerto No. 1 in D Minor—2nd and 3rd movement. Mozart: Concerto No. 20 in D Minor, K.466—2nd movement. EB.332.

Schumann: Concerto in A Minor, Op. 54—2nd movement. Beethoven: Concerto No. 3 in C Minor, Op. 37—1st movement. EB.333.

Grieg: Concerto in A Minor, Op. 16—1st movement. Tschaikovsky: Concerto No. 1 in B Flat Minor, Op. 23—1st movement. EB.334.

Rachmaninoff: Concerto No. 2 in C Minor, Op. 19—3rd movement. Gershwin. Rhapsody in Blue—Andantino moderato. JESUS MARIA SANROMA (Pno.) and VICTOR SYMPHONY ORCHESTRA, conducted by Charles O'Connell. EB.335.

ALL H.M.V. RECORDINGS.

In each of these records, the movements concerned has been cut down to a single side, being considerably compressed in the process. Just how you regard such matters depends, as do most things, on your point of view.

Nearly all the works selected have been more or less hammered into popularity. Some of them have suffered at the hands of popular song writers, who haven't spared even the lovely little concerto of Grieg.

Does this treatment really bring a taste for the classics to the average man? Frankly I doubt it. It is merely a compliment by the implication that the "longhairs" have written melodies which, even in their swing form, can beat Tin Pan Alley boys at their own game.

In the case of the Tschaikovsky concerto, for instance, everyone now knows how it opens. Has the popular song encouraged anyone to learn how the rest of it goes? I don't think so.

Considering these records in particular, I would not for a moment suggest that liberties have been taken with the score. The arrangers have simply cut slices in order that the 4-minute limit may be observed, like a three-day Test Match.

I would say that anyone who has enough interest in these works to be satisfied with the "highlights" would no doubt look upon them as a good thing. As for myself, I happen to know most of them note for note, and find it definitely distressing to play them through in condensed form.

I am afraid there will be many like me, to whom the net effect is one of strain, comparable to that which would be felt in a concert hall should everyone suddenly lose their places, and jump twenty bars by turning over two pages at a time.

THE DIGEST MIND

However, what cutting there is has been done fairly intelligently, and with the reservations outlined above, what remains is satisfactory.

As to the performance, it is quite good. Sanroma is a versatile pianist, possibly more spectacular than sensitive, but one whose records in the past have always commanded respect. In fact, here and there he plays us passages in a manner not often improved upon even by some of the best names of the keyboard.

I can only hope that possession of these records will result in the owner eventually acquiring copies of the various works in full. At least they will give him an excellent cross-section of musical style over a variety of musical periods. I only hope it is not a sign of the times, and that it will not encourage the Digest habit in music. The Digest mind seems to me as being a very dangerous product of our fast-moving age.

MARIAN ANDERSON, Contralto, with Victor Symphony Orchestra. THE MESSIAH—"He Shall Feed His Flock" and "He was Despised and Rejected." HMV ED.436.

Without doubt, this is one of the finest records I have heard for many a day. Particularly in the first-named, it has about everything one could ask for.

Marian Anderson has built up a reputation for her records, one which is unique as her voice and artistry are unique. In this example, she exhibits once more her wonderful range, superb control, and a musicianship which gives us the impression of great vitality and emotional power under full restraint. The result is a nobility and richness which are almost too perfect to be perfection.

The orchestra supplies a fine accompaniment, both in performance and recording. It is never obtrusive, supplying just the right background for perfect combination.

HEDDLE NASH, Tenor, with Philharmonic Chamber Orchestra, cond. by Maurice Miles. The Messiah (Handel)—"Every Valley Shall Be Exalted" and "Comfort Ye, My People." HMV EB.340.

Another good record, if scarcely in the same class as that of Marian Anderson. Heddle Nash is one of England's most popular tenors in this role, although personally I have found Webster Booth even more successful. There is a touch of emotional unrestraint, or tendency to "gush," which I personally find difficult to accept without some reservation. It is true that this remark applies somewhat less in this case than in some others I could mention. Recording and other features are good, and it should be a popular record.

PHILADELPHIA ORCHESTRA, conducted by Leopold Stokowski, "Adoramus Te" and "Sonata in E Flat Major for Pedal Clavier." HMV ED.435.

Almost made to order, this record slides off the Philadelphia production line with all the finish that marks their efforts of this type. More than this there is not much to be said. It is neither a shattering recording peak, nor a mere pot-boiler. Just good reliable work in a role which some day we will value perhaps more than we do at present. There are half-a-dozen of these smaller Philadelphia efforts which can match for competence and musical worth anything in the catalogue.

LONDON SYMPHONY ORCHESTRA, conducted by Maurice Miles, "The Messiah" (Handel)—"Overture" and "Pastoral Symphony." Columbia DOX.306.

Very smoothly and effectively played are these eternal Christmas associations—highlights of a justly famous work. The Pastoral Symphony if anything, I thought the best, although they are of fairly even quality. The recording has no obvious flaws. Lovers of Oratorio, or just good orchestral playing, should hear it.

ISOBEL BAILLIE, Soprano, with instrumental accompaniment. Recit.: "Shall Pales be the Last?" and Aria: "Flocks in Pastures Green Abiding." Columbia DOX.307.

It is a pity this excellent singer does not record a little better. I have noticed in most of her records a tendency to resonance or shrillness in a few spots which falsify the full merit of her performances. Actually she sings this type of stuff very well indeed, and as such she scores a complete success. My only complaint, if it can be so called, is a little regret that this characteristics imperfection should be in evidence. It is highly likely that with some pick-ups, it will be more noticeable than with others.

It is in orchestral music

that many find their supreme enjoyment of musical art. Soon, we hope, it will be once more possible to indulge in the delight of orchestral concerts in the home, presented by the world's best orchestras under the world's best conductors.

SOME OF THE FAMOUS CONDUCTORS WHOSE ART IS PRESERVED ON RECORDS:

Beecham	Toscanini	Sargent
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Harty	Mitropoulos	Boult
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UNIVERSAL SPEAKER TEST UNIT

(Continued from Page 53)

If the output transformer is built on to the chassis, simply plug the audio output leads into the voice coil pin jacks and ignore the output transformer in the instrument. In fact, switching S3 across to R10 will disconnect the output transformer altogether.

SPEAKER CONNECTION

Yet again, the speaker socket may be connected up in some odd fashion. Trace out the individual leads and plug them into the unit as necessary. In fact, the banana plugs can be numbered by making small saw cuts in the bakelite portion. Interconnection between any two of the leads can very simply be arranged by twisting a scrap of copper wire around to two banana plugs, or by inserting one in the correct pin jack and clipping the other under the corresponding terminal. The five-pin plug will normally be used for push-pull output systems.

So much for the construction of the unit and the cords. The two mentioned have met all requirements to date in respect to our own unit, but special circumstances may warrant other plug arrangements. However, there is no great problem about this.

When the unit is otherwise completed, lay it on its back and, with a soft fine brush, give the panel a coat of grey lacquer. Indeed, if you are careful to avoid scratches, the panel can be roughened and lacquered immediately after all the necessary holes have been drilled.

FINISHING

When the grey lacquer is dry, obtain some good quality black enamel and with the best type of pen at your disposal, print in the load and field resistance values for all switch positions. Mark the positions for S3 and brand the various terminals and pin jacks. If you can arrange to have the panel lettered commercially so much the better, but even mediocre printing is better than none at all. The switch positions can be spotted evenly by starting a small hole opposite the tips of the pointer knobs on each position, and running in a spot of black lacquer.

The original unit was housed in a leatherette carrying case just large enough to receive the 8in. x 7in. panel and 4½in. deep inside.

The detachable lid, carrying handle and rubber feet, are optional, but lend a professional touch to the instrument.

The loudspeaker for use with the instrument should have a voice coil impedance of 2.3 ohms or thereabouts and must be of the permagnetic type. The whole versatility of the instrument would be ruined if it were necessary by some roundabout means to excite a field coil from the set under test. An 8in. speaker is a good choice, combining reasonable ruggedness with fairly average general characteristics.

Housing the speaker is a matter which calls for some consideration. One scheme is to mount it on a fairly generous baffle above the service bench and tilted downwards. The arrangement permits good quality reproduction but hum in the output is not so easily detected if the speaker is too far away.

On the other hand, mounting the speaker on a small baffle at ear height, or in a small box allows one to judge hum level better but restricts bass response drastically, making it difficult to evaluate the tonal qualities of a set under test.

In our own case two distinct speakers are used, and it is simply a matter of plugging in one or the other, according to requirements.

One is a standard 10in. speaker on a fairly large baffle. This is used for all ordinary testing. The other is a small unit in a carrying case identical with the one which houses the speaker unit proper.

Small speakers with suitable voice coil impedance are now available and they are handy on occasions when someone else is trying to work in the laboratory at the same time.

A FIVE-VALVE VIBRATOR RECEIVER

(Continued from Page 45)

Even on the straight broadcast version, this extra choke may be helpful if any trouble is experienced with vibrator hash.

In mounting this choke, do not mount the winding in the same plane as that on either side of the filament chokes nearby. It is shown mounted this way in the underneath photograph, but was later mounted on edge to prevent it picking up a high frequency ripple.

Constructional details of the power supply unit were treated at some length in the last issue, so that complete repetition is not warranted here. Briefly, however, the components contained within the dotted line are mounted above and below a metal base plate which measures 5½ x 3¾ inches.

This assembly is then mounted with a metal shield box measuring 6 x 4½ x 4¾ inches, with a top lid to complete the shielding. Finally, this shield box is mounted on the chassis over the space originally intended for the a-c power supply components. Care must be taken, however, to see that the box and mounting bolts are initially insulated from the chassis, the only electrical connection between vibrator unit and chassis proper being a short length of copper braiding.

When the receiver is being tested, various positions can be tried for this earthing braid to determine the one which gives the least hash in the output. With a little care in this respect, and the addition of the R.F. choke previously mentioned, there was no noticeable vibrator hash at any point on either broadcast or the short-wave band.

The alignment procedure is quite usual. If you have an oscillator on hand, begin by aligning the I.F. transformers on 455 kc, keeping the signal input as low as possible and the volume control well advanced in order to offset the effects of the A.V.C. circuit. If no oscillator is on hand, leave the I.F. transformers alone for the time being.

Switch to the broadcast band and tune a weak signal from a station or from the oscillator in the vicinity of 1400 kc and peak the aerial and R.F. trimmers for maximum output.

Now tune a weak signal at about 600 kc, and adjust the aerial and R.F. coil cores for maximum output. If the coils are of the fixed inductance type, a variable padder must be used, and this will provide the necessary adjustment at the low frequency end of the band. In this case, tune the 600 kc signal and, while retuning the dial as necessary, vary the setting of the padder until an adjustment is found which gives the loudest signal.

Never attempt to use a variable padder with variable inductance coils, as this will lead to endless confusion.

Having carried out the adjustment at the low frequency end of the band, tune in a known signal at the low frequency end of the band and set the dial pointer so that it is indicating the correct station call sign on the dial.

Retune the receiver to another known station at about 1400 kc, and, by varying the oscillator trimmer, shift the station along to its correct calibrated position on the dial. Then re-check the aerial and R.F. trimmers. If you feel energetic, the whole alignment process can be repeated.

Finally, if the I.F. transformers were not aligned beforehand, tune a weak signal and touch up each of the I.F. transformer adjustments for maximum signal strength.

The procedure on the short-wave band is much the same. Peak the aerial and R.F. trimmers for maximum signal strength at the high frequency end of the band. Then, if the coils are of the variable inductance type, tune to the low frequency end of the band and adjust the aerial and R.F. cores for maximum sensitivity. If the coils are of fixed inductance, no adjustment is usually possible at the low frequency end of the band.

Screwing the oscillator trimmer in or out will affect the frequency coverage at the high frequency end of the band, so that, if you are sufficiently familiar with the short-wave stations, the international bands can be lined up with the dial calibrations. Adjust the oscillator trimmer as necessary and peak the aerial and R.F. trimmers again for maximum output.

This done, your dual-wave Vibra-Five should be ready for a long period of useful service.

COURSE IN RADIO TRANSMITTERS

possible to secure a satisfictory impedance match under a variety of conditions. Do not forget that a match within a few per cent. one way of the other is generally satsifactory, there being no real need for getting down to a correct ratio within one or two turns. The use of a multi-ratio transformer has a special application in amateur transmitters where a modulation transformer constructed along these lines enables the station operator to experiment with various combinations of valves in the transmitter.

The particular turns ratio necessary in the modulation transformer will naturally depend upon the load impedance presented by the modulated stage, and recommended load impedance for the particular valve or valves used in the modulator stage. The load presented by the modulated amplifier is dictated largely by the method of modulation employed and the type of valve used in the modulated stage.

As an actual example, let us assume that it is necessary to plate modulate a single 807 operated as a Class C radio-frequency amplifier, with a plate input of 32 watts. Under such conditions the modulator would have to

(Continued from Page 37)

supply at least 16 watts of audio power at 100 per cent. modulation. A pair of 6L6 or 807 valves operated under Class AB1 conditions, with plate and screen voltages of 360 volts and 270 volts respectively, and minus 22½ volts grid bias, will deliver 18 watts of audio power. The required plate-load impedance for such operation is 3800 ohms plate to plate.

MODULATOR LOAD

As with plate modulation, the output from the modulator is placed in series with the modulated amplifier's plate and screen circuits, the load presented to the modulator will be equal to the combined resistance of these circuits. Using a single Class C operated 807 under the previously stated conditions, namely, 32 watts plate input, the plate voltage would be 400 volts, while the plate current is 80 milliamps and the screen current 10 milliamps. A current flow of 90 milliamps with an applied voltage of 400 volts represents a resistance of 4500 ohms approx. This, then, is the impedance which would be presented to the plate circuit of the modulator. Now, we have already stated that the correct load-impedance for the modulator valves is 3800 ohms. The situation, therefore, calls for a matching transformer.

The calculation of the required turns ratio in the transformer is quite an easy matter, and is carried out by using the formula already quoted.

The source impedance is, of course, 3800 ohms, while the load impedance is 4500 ohms. Using the above-mentioned formula, the result would be

Turns ratio = square root of impedance ratio
= square root of 1.2.
= 1.1.

Turns ratio equals 1.1 to 1.

With a modulation transformer having a turns ratio of 1.1:1, a load of 4500 ohms connected to the secondary winding would cause an impedance of 3800 ohms to appear across the primary winding. The modulator would, therefore, be accurately matched to the modulated stage.

Actually, it is somewhat difficult to arrange for both plate and screen to be fully modulated at the same instant without a special modulation transformer having two secondaries, one for each, in order that the modulating power may be correctly divided between them. An examination of this point is rather complex, however, and, in practice, modulation percentages closely approaching 100 per cent. are usually obtained using a screen-dropping resistor.

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ROCKING TOYS

(Continued from page 65)

shown in the diagram. These are made from three-ply and the design may be drawn direct or enlarged on a sheet of paper and transferred to the wood. Don't forget the small tongue on the foot.

A small mortice is cut in each end of the cross arm to take the tongue on the figures. As suggested for the first toy, cut these with a coping saw. Glue the figures in place, using small wedges if necessary, to hold them firmly, and when the glue has set, clean off the underneath side.

Place the figures which have been glued to the cross arm on the base and touch it gently to see if the balance is correct. It should see-saw merrily from side to side. But if not, slightly alter the position and when the adjustment is right, carefully mark the place. It is then glued and nailed in position, using three or four fine panel pins.

PAINTING

Paint the rocker and arm green, the clowns' suits yellow and their collars and caps red. The hands and faces are a flesh color. Fill in the details, such as shoes and buttons, in black and outline the features and colors with a thin black line.

Of course any other figures of suitable size and shape can be used. As well, instead of making the rocker base as shown, a shape made from a solid block of wood, rounded to resemble half a ball, can be substituted. The figures will then roll in any direction.

THE HAM BANDS

(Continued from Page 68)

W.I.A. DOINGS

November meeting of the NSW division saw the disposal of the released gear to city members. They were well pleased with their bargains.

NSW W.I.A. Field day will be held at Wyong on January 26—keep that day open.

Nominations were called from amongst the members for the Experimental Advisory committee and these names will be submitted to the Wireless Branch.

QSL cards for overseas stations will be charged for at the rate of ½d per card, as from January 1. This will bring the QSL Bureau in line with other States, as requested at the last Federal convention.

VK DX CONTEST

Final weekend of the test went off smoothly, more stations were active, the publicity of the previous week-and brought them into line.

Scores: 2EO 199 contacts, 2JX 160, 2RA 135. 2QL 122, 2VN 100.

Newcastle gang 2ZC, 2AHA, 2YL, and 2ADT were also well up and the highest was reported to have 135 contacts.

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ANSWERS TO CORRESPONDENTS

UNDER THE PERSONAL SUPERVISION OF THE TECHNICAL EDITOR

A.E.B. (Movwell, Victoria) writes in appreciation of the recent articles in "Radio and Hobbies" on transmitters, but suggests he would like to see an article especially on power supplies.

A. Many thanks for your letter and your request will be kept in mind. In some ways it is a good thing for new amateurs to start with limited power, because they are obliged to adjust the equipment for efficient operation. However, the effect of the present regulations is to more or less compel this approach.

N.B. (East Malvern, Victoria) reports having built up "Little Jim" with some success, but mentions that stations tend to run together when using a home-made coil.

A. The trouble you complain of is clearly lack of selectivity, which is more or less a characteristic of any small receiver using only a single tuned circuit. The only way you can effect improvement would be to experiment with the length of aerial, and also the nature of the aerial coil primary winding. By reducing to a minmium the number of turns on the primary and spacing it away from the grid coil you can improve selectivity at the cost of signal strength.

M.F.C. (Coramba, NSW) sends in a contribution for our "Reader Built It" page.

A. Many thanks for your letter and for the very handy hint contained therein.

B.T. (Five Dock, NSW) reports having built up with success the crystal set recently described. He is now keen to build a one-valve receiver, but finds that sets like the "1Q5-One" are too complicated.

A. Many thanks for your report on this set, but we have nothing to offer in the way of an article more detailed than the one which dealt with the 1Q5 receiver. We suggest you keep on reading "R. and H." for a while yet, and you will probably find that a lot of your difficulties will disappear.

C.L.J. (Camberwell, Vic.) asks what dial was used on the "Amateur Junior" receiver.

A. The dial used was a standard movement fitted with a RCS dial glass. The dial glass should ideally be one calibrated 0 to 100 to avoid possible confusion in operating the receiver. Apart from the fact that it should fit the chassis, the type of dial movement is not particularly critical since the band spread arrangement renders tuning relatively broad.

I.C.S. (Paradise, South Australia) comments at length on our various features and suggests that he would like to have seen the Broadcast Band DX page retained.

A. Many thanks for your letter and your various comments which were read with interest. We agree that some readers could do with fewer illustrations and less detail in our articles, but, for every opinion so expressed, there are others who would like to see even more pictures and more explanation. We strike what we believe to be a happy medium in the allocation of space and subject matter.

D.P. (Caulfield, Vic.) sends in a variety of circuits for comment.

A. Your one-valve and two-valve circuits are fairly conventional and would doubtless give excellent results in their class. The two amplifier circuits are workable but one or two of the constants are open to question. The a-c amplifier in particular would operate with an excessive high tension voltage, due to the relatively low resistance of the filter circuit. If you are interested in running a small set completely from the a-c power mains, why not look up our "Monty" circuit in the July, 1945, issue. Alternatively we can supply the circuit, wiring diagram and parts list through the Query Service. Your request for details regarding the construction of a multimeter has been met in recent issues. We doubt whether you could expect any success in operating the filaments of battery valves from a trickle charger. Even assuming that you could adjust the voltage adequately, the output would be far from pure d-c and may produce a severe hum in the loudspeaker or phones.

R.A.F. (New Town, Tasmania) writes in appreciation of recent amateur features, but suggests that attention be given to auxiliary apparatus for the amateur station.

A. Many thanks for your letter, R.A.F., and we note your request for the special articles. We appreciate the need for these and will cover the ground just as quickly as we are able.

W.B. (Yarraville) sends in for comment his circuit of a three-valve receiver.

A. The circuit is fairly straightforward, and should have much the same general characteristics as other regenerative sets of this type. The reaction control is a little unusual, but we take it that you have made this function satisfactorily. The only worthwhile addition would be to instal a volume control in the grid circuit of the 6V6GT. You could then afford to operate the reaction control near the point of oscillation, and set the volume at a suitable level. You will find that the set is most selective with the reaction control set just below the point of oscillation. The only other useful contribution you could make to selectivity would be by the addition of a tuned R.F. stage.

T.J.T. (Ulverstone, Tas.) reports having built up a crystal set similar to one described in the October issue but using a coil comprising 108 turns of 28 gauge enamelled wire on a 1¼in. former. Besides the local station he reports reception of 7AD, 10 miles distant, and 7NT, which is 70 miles away.

A. Many thanks for your report on the crystal set and you are certainly doing well to hear 7NT. It is hard to say whether our coil would be better than the one you are using, although the only sure way is to experiment with it.

S.H.S. (Croydon, NSW) states his likes and dislikes about "Radio and Hobbies," mentioning particularly the disappearance of the broadcast band DX page.

A. Many thanks for your letter, which was read with interest. We note your remarks about the particular feature but cannot see our way clear immediately to replace it. Neither can we suggest any other source of the information you require. However, Mr. Hallett may be able to help you out in this matter and we suggest you write to him at 36 Baker-street, Enfield, NSW.

"A Reader" (Epping, NSW) comments on the simple oscillograph featured in the November, 1946, issue. He suggests that the sweep voltage is actually pure a-c from the power transformer secondary.

A. No, there is no error or discrepancy in the circuit. If the top end of the winding were rigidly at earth potential, then the sweep voltage would admittedly be a pure a-c wave form. However, the top of the secondary is returned to earth through a filter condenser which periodically receives d-c charging pulse. This modifies the whole relationship of the high tension secondary winding to earth, so that the sweep voltage is essentially a combination of the a-c across the winding and the pulsing d-c potential across the filter condenser. We cross-checked on the sweep pattern with a second C.R.O. to verify the above. A return trace is definitely present but it is over a shorter time interval than the forward trace so that the pattern is correspondingly reduced in intensity. In fact, return trace can only be seen with the intensity control well advanced.

G.D. (Hobart, Tas.) suggests that we should publish an article detailing the construction of a wire recorder.

A. Many thanks for your letter, G.D., and for the suggestion. We did give the matter some thought a few months ago, but found that the project was not nearly as simple as one might at first imagine. One of the immediate problems was that we found it quite impossible to purchase in Sydney wire of suitable magnetic properties. With the pressure of work as it is at the moment, we cannot see our way clear to follow up the matter again in the immediate future.

B.F. (Thorbury, Vic.) enquires about the price of back numbers.

A. Back numbers of "Radio & Hobbies" are sold on the basis of the original cost (6d.) plus 1d. per month out of date, maximum price being 2/6 for very old issues. However, there are actually very few back numbers available. We note your request regarding articles and circuits for beginners and feel that recent features in the magazine will have pleased you.

A.E.L. (Perth, WA) asks a number of questions which are answered in order:

(1.) There are special frequency test records available on the Australian market, and we suggest that you place an order through your nearest record distributor. We are not sure whether the records are available singly or in sets, but one which would be particularly useful is the Gliding Frequency record, HMV ED.302. You will not hear many tones from an orchestra at a frequency lower than 40 cycles per second. What you hear when this frequency is fed from the power mains into the amplifier is harmonic output as much as anything else. (2.) There is not much point in recommending any particular loudspeaker combination at the moment, since none are readily available. We suggest you defer a decision on the matter for a few weeks until we can get around to more specialised work on reproduction with current type loudspeakers. (3.) We have no immediate plans to describe a direct coupled amplifier, and, in fact, we are not particularly convinced about their virtues. (4.) We do not know whether any particular fee can be regarded as "usual" for man-hours in the radio repair business. It varies widely according to the capabilities and inclinations of the serviceman.

C.T.C. (Brisbane, Q.) tells how he has been a continual reader of "Radio & Hobbies" and at one time or another has built practically every receiver that we have ever described.

A. Many thanks, C.T.C., for your letter and your encouraging remarks in regard to our magazine. We certainly trust that you will continue to find constructional articles of interest in the magazine in the months to come.

F.K. (Birriegurra, Vic.) sends along an advertisement and comments that he would like to see more about portable receivers in "Radio & Hobbies."

A. Many thanks for the advertisement which has duly been inserted. Quite lengthy articles on portable sets appeared in the September and October issues and further articles will doubtless be given as space and circumstances permit.

HOW TO SUBMIT YOUR QUERY

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.

2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."

3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."

4. Blueprints of exact size chassis layouts with all essential holes and cut-outs will be supplied if available for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, "Radio & Hobbies," Box 2728C, GPO, Sydney.

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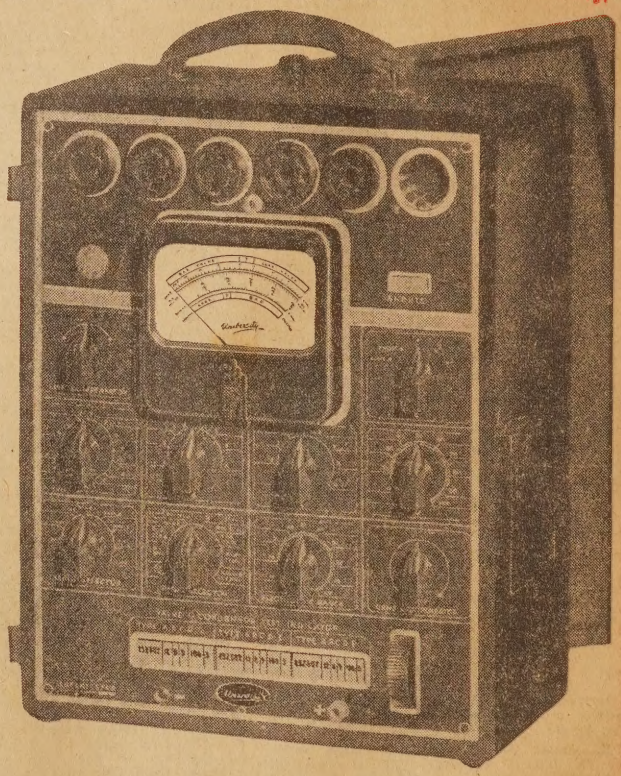

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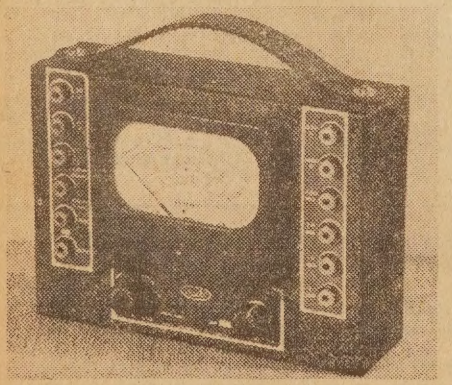

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F.C. (Boggabri) asks for an explanation of why a dual-wave set reduces the signal strength of two other receivers which are connected to the same aerial.

A. There is no problem about this. When more than one set is connected to the same aerial the signal voltages are shared between them, although there may still be adequate signal to receive programmes in the normal way. However, when one receiver is switched to the short-wave band (irrespective of whether it is operating or not) most of the signal is routed to earth through the low impedance short-wave aerial primary. Removing the earth wire from the other sets minimises the affect of this shunting. We trust that this explanation will clear up your difficulty.

J.A.G. (Armadale, Vic.) is interested in using a large 12in. cathode ray tube which is available.

A. Sorry, but we have no detailed information on these tubes so cannot answer any of your questions regarding operating voltages, &c. However, we understand that they are designed for magnetic deflection and are, therefore not applicable directly in circuits which provide for electro-static deflection. It is certainly possible to connect two 6.3 volt windings in series to give 12.6 volts, but you will have to make sure that they are correctly phased, otherwise the net voltage across them will be zero. Glad to note that the two-valve receiver is going so well. Thanks again for your appreciative remarks in regard to "Radio & Hobbies."

G.M. (Ebenezer) reports having built up the 10 watt fidelity amplifier (November, 1945) with excellent results on pickup, and also on microphone and film sound track with a .1603 preamplifier added.

A. Many thanks for your letter, and glad to note that the amplifier is going so well. Your subscription has been duly recorded.

K.A.B. (Arncliffe, NSW) built up a three valve portable in 1940 and says he would now like to rebuild it into a four valve receiver.

A. Assuming you used the 1D8GT valve in the original, there would not be a great deal of point simply in rebuilding the set to replace this valve with a 1H5GT and a 1Q5GT. As you are apparently anxious to use the two gang condenser the obvious step would be to include another I.F. amplifier stage. However, we have no circuits to supply along these lines. The best plan of all would be to purchase a three gang condenser and rebuild to the circuit of the "1941 Portable" as reproduced in the September, 1946, issue.

W.J.P. (Waratah, NSW) reports having built up a set along the lines of the "1Q5-Two," but using a type 30 valve in the output. The detector does not operate very well with more than about nine volts for the plate supply.

A. To judge by the list of stations you mention in your letter, the set is not doing at all badly with only a small aerial and no earth. Increasing the detector plate voltage possibly renders the reaction control ineffective, so we suggest leaving things as they are. The wave trap suggested in the November issue will probably minimise your trouble with the local station. The addition of an R.F. stage would also improve materially the gain and selectivity, although it would naturally complicate the receiver quite a bit.

R.V.F. (Naracoorte, SA) thanks us for information supplied through the shilling query service and asks about the "Serviceman Who Tells" feature.

A. Many thanks for your letter, R.V.F., and glad to note that the set is now performing as it should. Isolating the power supply in the way you suggest may improve the hum level although such drastic measures are not usually required. "The Serviceman Who Tells" feature had to be discontinued earlier in the war and we have not since made any decision about restoring it to the magazine.

V.L. (Meandah, Q.) is another reader who is very keen to see described a large radiogram, preferably with push-pull 807 valves in the output for plenty of power.

A. Thanks for your letter and we quite appreciate your feelings in regard to a big set. We definitely intend to describe a large receiver in the near future, but it is rather early just at the moment to indicate the exact date.

H.A.O. (Hawthorn, Vic.) enquires about some figures recently published in regard to a transport aircraft.

A. We have no simple means of re-checking the figures, but think that they are correct. The specific gravity of aviation petrol is about 0.72, which leaves a big margin between the weight of the maximum petrol load and the figure given for gross load. In estimating the weight of the petrol, you have allowed for too high a specific gravity and also introduced an extra nought into your answer.

POWER TRANSFORMER CONNECTIONS

QUESTION:

In connecting up a power transformer various windings have to be returned to the chassis. Which windings are so affected, and why are connections to the chassis necessary?

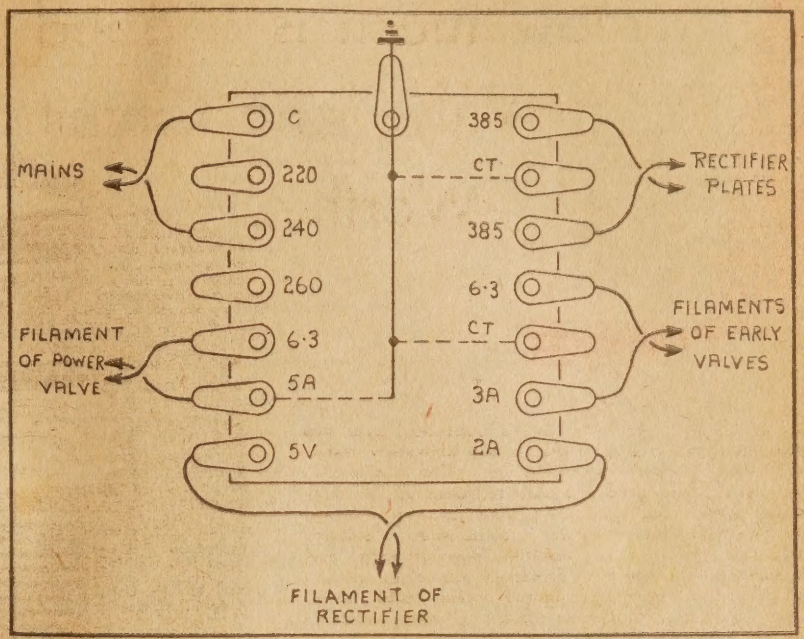

Figure 6. Showing a typical power transformer terminal panel and the connections which need to be made to it. Dotted lines show probable earth connections.

AN ordinary radio type power transformer has the following windings: A primary winding with possibly one or two extra tappings for different mains voltages, a centre-tapped high voltage secondary winding, a filament winding for the filament of the rectifier and one or two other windings for the filaments of the valves other than the rectifier.

The primary winding must naturally be connected to the power mains. Where a terminal panel is fitted, this is normally to the connections marked "C" and "240". The 220 and 260 volt tappings, where provided, are only used when the receiver is operated in a district in which the line voltage is consistently much higher or lower than the usual 240 volts.

This primary winding should never be connected to the chassis; in fact pains should be taken to see that there is no possibility of accidental interconnection. If there were such a connection, the chassis might well become alive, either constituting a danger to the operator or else short-circuiting the mains through the earth lead

In between the primary and the other windings, most power transformers have a thin metallic shield, whose purpose it is to prevent line disturbances reaching the circuits of the receiver and thereby causing noise. This "electrostatic shield," as it is called, is often connected to a terminal on the panel marked "E," which should be earthed to the chassis.

In some transformers, however, the lead from the electrostatic shield is simply pushed in between the laminations, or else soldered to a lug beneath one of the mounting screws. In these cases a separate earth connection on the panel is not called for.

The centre-tap of the high-tension secondary winding must return to earth in some definite fashion in order to complete the d-c output circuit through the rectifier.

In most receivers, the high tension centre tap is earthed directly. In others it goes to earth through a back-bias resistor, across which a d-c voltage is developed for biasing one or more of the amplifying valves.

The outer ends of the winding are at a high potential with respect to earth and care must be taken with the wiring, soldering and flux to see that no short-circuit can occur to overload and burn out the transformer.

In the usual receiver circuit, the filament of the rectifier is at a high d-c potential with respect to earth—usually about 400 volts. Care must be taken to avoid risk of short circuit here and, naturally, no earth connection should be made to the filament winding or circuit of the rectifier.

Only exception to this rule is the case of indirectly heated rectifiers such as the 6X5-GT, which are occasionally supplied from the same heater winding as the other valves in the receiver, the heater being at earth potential and the cathode at a high positive voltage.

Where all the other valves in the receiver are of the indirectly heated type, it is usual to earth the other heater windings, either by means of the winding centre-tap or by means of a centre-tapped resistor, or simply by one side of the winding.

Failure to earth the heater windings often causes a high buzzing noise in the output, or a modulation hum on stations. Yet again it may contribute to instability of the receiver, due to feedback through the heater wiring.

Earthing the heater circuit by way of the centre-tap is generally to be preferred, although earthing one side is quite satisfactory where no centre-tap is available.

Where the receiver incorporates a directly heated valve, the associated heater winding must necessarily be returned in some manner to earth, either through the centre-tap or a centre-tapped resistor. If the circuit calls for the heaters to be earthed, the connection should be made. If the valves is self-biased, there will normally be a bias resistor inserted between the heater winding and earth.

Failure to return the filament circuit of a directly heated valve to earth in some way or other means that there is not return path for the plate and screen current, so that valve cannot function.

In receivers and amplifiers, it is wise to avoid returning the earth busbar connecting to earlier stages in the receiver to the mounting bolts of a horizontal type power transformer.

The mounting bolts appear to be a focal point for eddy currents and it is frequently found that hum is introduced into earlier stages if the main earth busbar is brought round to a lug under a mounting screw. There is no objection, however, to earthing the filament circuits, electrostatic shield or high tension centre-tap to this point.

WANTED TO BUY, SELL OR EXCHANGE.

Readers wishing to buy, sell or exchange goods are invited to insert an advertisement in this column. The cost is 9d per line; minimum charge 2/3. Approximately 6 words to a line. Advertisements for the next issue must reach our office by WEDNESDAY, JANUARY 8. Dealers advertisements not accepted.

EXCHANGE for multi-meter or sell 10/- each, 5-1L5's, 2-1D5's, 3 1C7's, 3 1-M5's, 1-1K7, 1-6J5MT, 1-6K7-MT. **R. Bockman, 8 Innesdale St., Arncliffe.**

EXCHANGE unused ICS, Radio Servicing Course (cost £26) for any cash offer or radio parts. All replies answered. **R. McRitchie, P.O., Whyalla, S.A.**

FOR SALE: One vibrator power pack, works off 6v Battery, gives 290v at 50 mill, or 175v at 40 mill., brand new and built to stand rough usage, £10. New Palec 0-1 Thermo-Ampmeter, plug in type, £3. Guaranteed new valves 2-1K7, 2-1C7, 1K5, 2-1L5 at 10/- each, new 807 at 20/-. Also number of used single gang condensers and audio transformers. Write to **Charles Clive, Clark St., Charters Towers, Queensland.**

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FOR SALE: 1 3-gang cond., 2.8 mfd and 2 10 mfd electrolytic cond., vib., trans., 6v to 250v at 50 M.A. R.C.S., LT. vib. choke. H.T. vib. choke, 1 34, 2 32 valves. £5 the lot. **L. Muller, Nobby, Queensland.**

FOR SALE: Permag, speaker, H.2 Stromberg condenser, RCS Dual Wave coil kit. 2 Iron core intermediate 2-8 mfd. electrolytic, 75 mill. choke, £7. Also console cabinet, £8/10/-. **A. Taylor, 9 Albyn-st., Bexley.**

FOR SALE OR EXCHANGE: 1 Palec valve and circuit tester, model V.C.T.-V., A.C., and vibrator, as new, complete, £20, or exchange for typewriter, portable preferred. **P. Burrows, Box 72, Stanhope, Vic.**

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